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JOURNAL

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Mold for a television lens after final polishing operations.

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Across the Editor's Desk

This copy of the SPE Journal is the largest yet—76 pages—and still we had to leave out a number of interesting things! Very few lines left even for the editor, so—briefly . . . . . .

ASTM Standards on Plastics . . . new edition, March 1953, well printed and easier to handle than the old editions, 705 pages, $5.75. ASTM, 1916 Race St., Philadelphia. Will review in Sept. SPE Journal.

Congratulations to Plastics World on their attractive new cover format!

George Hale Promotion

Appointment of George M. Hale as assistant manager of the industrial products division of Canadian Resins and Chemicals Limited is announced by R. J. Routhwell, sales manager.

Joining the company in 1946 on graduating from Queen's University with a master of science degree, Mr. Hale spent the next three years as development engineer at the company's development laboratories in Shawinigan Falls. At present he is in Toronto, where he has been attached to the district office as a technical representative since 1949, and will take up his new duties at the head office in Montreal shortly.

Adjustable Profile Template

Something new under the sun is "AJUSTO," a template for obtaining both male and female profiles in a matter of seconds. It is made of a number of hard brass strips, each one only 0.0007 inches thick. This permits close adjustment to practically any profile, yet provides extremely close tolerances. The plastics industry has found use for it in inspection, fabrication and duplication. Information on this interesting item can be had by writing to Toolcraft Manufacturing Co., 6619 South Dorchester Ave., Chicago 37, Illinois.

Little Gem Cabinet

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Top illustration shows a single "Little Gem" Cabinet, middle illustration shows two "Little Gems" stacked. Precision Equipment Co., 3714 Milwaukee Ave., Chicago 41, Ill. will be pleased to furnish literature and further information.

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Diversification of extruded Thermoplastic products line by well-established company located New Jersey metropolitan area creates excellent opportunity for man having some experience with rigid vinyls. Primary responsibility will be research and development. Please submit complete resume for prompt and confidential consideration to box # 1453, SPE Journal, 513 Security Bank Bldg., Athens, Ohio.

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ENGINEER

with experience in design of plastic products and is familiar with trade practices on tolerances; has knowledge of various plastic materials particularly as to their molding properties; experience with operation of molding equipment. Desired for research work in new molding techniques; developing experimental molds; conducting research into equipment, tools and methods; carrying out of experiments.

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Drilling water lines by the yard on a radial drill

Large

In recent years molded plastic products have increased tremendously in size. Not so long ago it would have been thought almost impossible to mold some of the articles that are now being molded, but the careful planning and forward thinking of a few years ago have resulted in this today becoming a reality.

This has meant, first of all, that larger molding presses have had to be designed and built, and this, in turn, has made necessary the building of larger and larger molds. Each, without the other, would have been impractical, if not totally impossible—and they both have been occasioned, basically, by the direct, or indirect demand of the designers and engineers of the manufacturing industries, who have created new products and new and expanding applications for increasingly larger molded plastic articles.

Still larger molded articles are being planned for the future.

ONE OF THE FIRST things to consider in large mold construction is the part drawing. This is where every mold has its beginning. It must be very carefully studied to make sure all parts of it can be molded, to see that all cored openings, generally speaking, are near the outside edges, to lend themselves to coring by means of cams, slides, pinions, or air or hydraulic cylinders. Openings or undercuts can be located near the center of a large molded part, and cored with angle pins from the ejector plate, or by some other means, provided the rest of the part is so designed as to offer no serious impediment to the resulting necessary type of construction.

The part drawing should also be looked over for ejector pin locations, for these must be very carefully selected. Often large plastic pieces cannot have ejector pin marks on the side which will be visible in service, except around the border, complicating the matter of ejection. All more or less vertical surfaces, and especially any existing ribs, in the cavity or core, should be generously drafted to aid ejection. Sometimes a careful scrutiny of the part will indicate surface angular breaks, causing natural lines, where possible ejector pin or blade marks will scarely be noticeable.

In connection with the general design and engineering of large molds the mold builder is often handicapped by having to quote from an article part drawing only, often incomplete, and rarely is he ever given the privilege—yes, it can even be said the "luxury"—of quoting from a mold drawing. There are so many differing possibilities of construction, and so much time and expense at stake, that this puts the mold builder at a serious disadvantage.

It can be stated as almost a general rule that most molders or prime customers have certain definite features that they want incorporated in the mold construction, but which the tool builder may not be aware of. This makes it difficult for a quotation to be made, for it must often be based upon generalities, and yet these differences of methods of construction, because the mold is large, can mean a variation of thousands of dollars in ultimate mold costs.

Sometimes, because of uncertainty on the molder's part as to whether or not a large cavity will properly fill with only one sprue, (usually where this is done directly into the part) the molder might be thinking in terms of a mold designed for rapid conversion to three plate, top runner construction, allowing more sprues to be added.

Sometimes the question of water lines and methods of cooling can mean a variation in costs. Some molders want continuous circuit channeling, some "zoned' cooling lines, some separate cold water bushings around sprue or cold slug, others internal distribution manifolds, others external distribution manifolds, and still others none at all.

Sometimes a special, deep injection nozzle might be indicated; sometimes three plate construction, instead of air cylinders, to actuate cam operated slides coring openings in cavity, might be the point in question; or perhaps the uncertainty might revolve about whether or not to sprue and eject from the same side, requiring costlier construction.

Many of these wide variations in construction can alter the mold costs by thousands of dollars. This was not as serious a drawback when molds were relatively small, but now that molds are large, these items can be vital factors in deciding whether the mold builder will be able to meet his costs, or whether he will operate at a loss on any particular job.

Because of the importance of this factor these details must be decided upon from the very beginning in order to provide adequate coverage, both as to cost, and also the time element in delivery. One of our customers with whom we have discussed this matter has agreed to submit with each request for a quotation on a large mold if any unusual features will be incorporated, a small but fairly comprehensive, preliminary sketch (letter size) of mold construction to aid in arriving at a fair cost estimate. This procedure is to be highly commended, and would be of much value to all builders of large molds, if followed by the molding industry in general.

Another factor which is more vitally connected with large mold construction is the question of delivery. When molds were small, an accurate date could easily be given. But with the advent of molds which take eighteen to

Mold Construction

John Andras
Major Mold & Die Co.

twenty-two weeks or more to build, it can easily be seen that a very close date is much more difficult to predict. There are so many variables that can disrupt the smooth flow of work from one operation to another—from kellering to milling to benching to spotting to polishing—that to pin point a specific date is virtually impossible.

Many factors enter the picture that affect delivery. Most large molds require keller models from which to machine, and these often take four, five, or even more weeks to complete. Most large molds require special steel forgings for the cavity and core because the sizes are much larger than those normally carried in stock by steel suppliers. These sometimes take anywhere from four to six weeks to obtain. It might be interjected here that for small molds, materials average about 10 to 15 per cent of total costs, but on large molds, requiring models and special forgings, costs can run as high as 25 to 30 per cent.

Another frequent delaying factor is engineering changes in the part. Often after weeks, or even months, of mold construction, part revisions are made which involve difficult and time consuming alterations in the mold, the proportions of which the customer does not always seem to properly evaluate. Where cavities and cores weighing thousands of pounds are involved almost any change runs into an extension of delivery time of weeks instead of days.

Still another cause of perhaps inordinate delay is the temporary holding up of a mold by the customer, perhaps pending some executive decision. If this mold, for instance, were on the keller when work was stopped, it would, naturally, be taken off and another put on in its place, for an expensive machine of this type could not be allowed to remain idle. When the call to resume work on the original mold would be made, therefore, work could not be stopped on the second mold until it was finished kellering, which could easily be a period of a month, perhaps even two. This often is not particularly liked, but actually cannot be avoided.

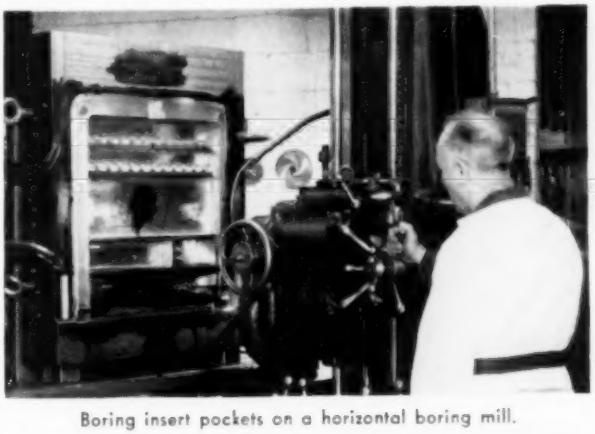
All of these factors, then—obtaining kellering models, procuring special steel forgings, engineering changes, and temporary stop-work orders—are circumstances over which the mold builder has no control, and yet they all vitally affect the delivery of his product.

In the building of large molds, problems are encountered which we do not face in building small molds. In conjunction with these is the matter of proper equipment. Of course it goes without saying that all the machine tools required to build large molds must be of adequate capacity, that is: kellers, vertical and horizontal mills, planers, radial drills, grinders, and the like.

The handling tools must also be of a type and size to properly perform an operation without waste of manpower. Two pieces of equipment that we have found indispensable in handling large die blocks are an electric hoist and an electric lift truck. Prior to the time we purchased this equipment, it often required as many as six men to move a large steel plate on a hand truck, whereas small molds can often be easily managed by one man throughout all the stages of construction. Now, properly equipped, one man can also handle this enormous weight lifting job easily.

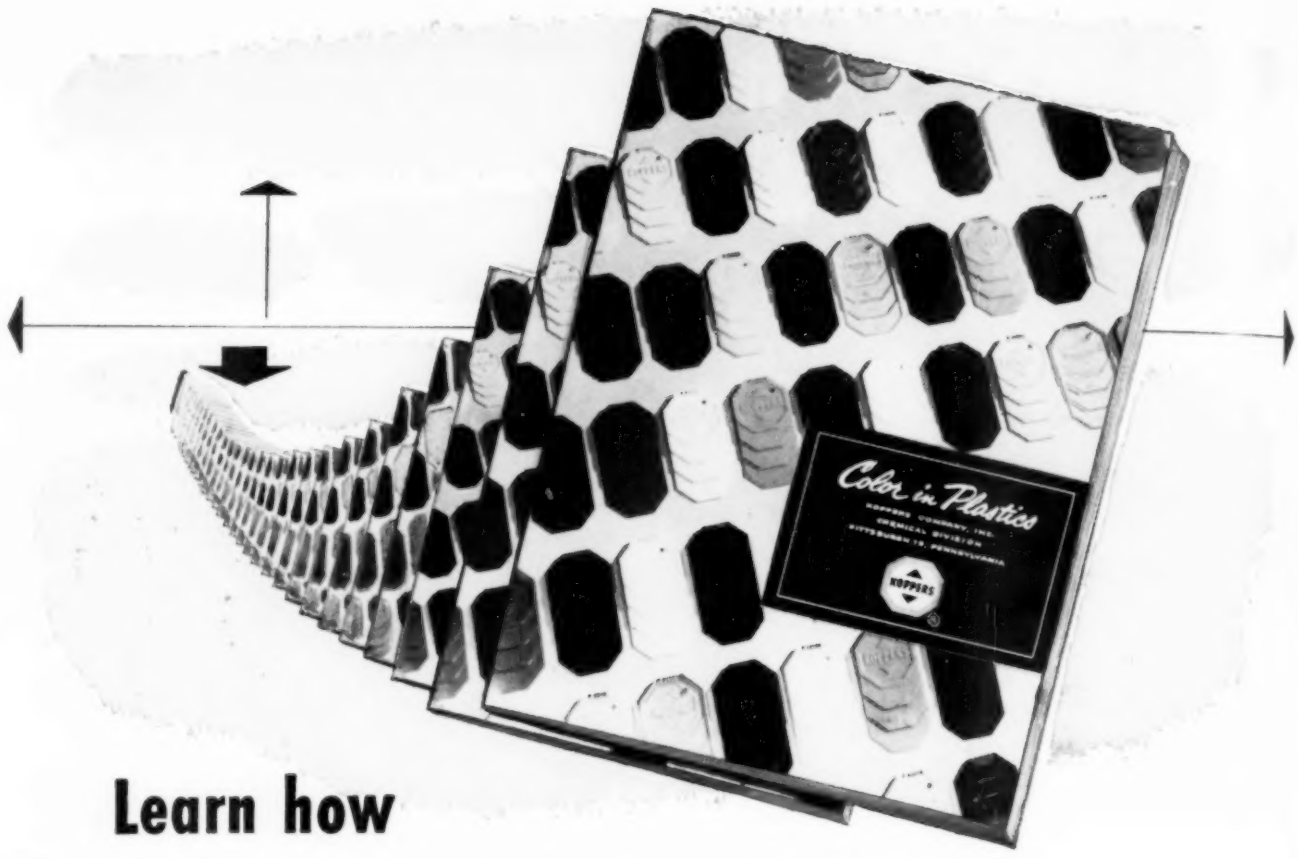
Along with the heavy equipment, the more delicate machines are also essential. One of these, the three-dimensional pantograph is invaluable. Most large molds call for engraving and fine rib work, often in the most difficult places. While this machine is very versatile, its capacity and size are necessarily limited. The pantograph operator's ability and ingenuity are often taxed to the limit in deciding just how to go about setting up a job, and how to reach some almost inaccessible surface. Sometimes the die block is so large it must be supported outside the pantograph itself, from the floor, or from some other fixture. The mold builder should always try to obtain permission to use inserts, where such use will allow the operator to do his machining on a small block outside, where

(Please turn to Page 74)



Boring insert pockets on a horizontal boring mill.

Duplicating the core of a refrigerator inner door panel mold from the wooden model on a Keller.



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Some Reminders in—

Mold Construction

Rene Magnenat
Waterbury Companies, Inc.

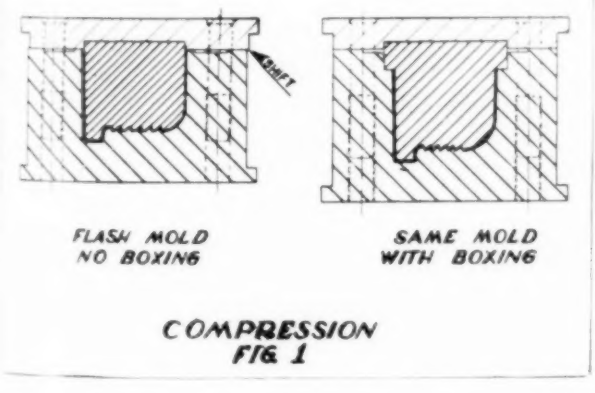
Both in mold design and mold making the natural tendency is to concentrate on the problems directly connected with the part to be molded, with the possibility that some seemingly less important factors may not be given sufficient attention. In some cases this may result in abnormal maintenance costs, delays, high rejection percentages or in extreme cases, inability to produce. The purpose of this paper is to review some of these factors which can be classified into three main groups.

1. **Alignment of mold halves**
2. **Ejection**
3. **Supporting and resisting pressure.**

ALIGNMENT BETWEEN MOLD HALVES has to do with the possible difference of alignment provided in the mold, with the one obtained on the molded part. Several factors must be kept in mind: (1) Whether the mold is under pressure before it is closed, especially on the large and deep single cavity of unbalanced design such as the radio cabinet compression mold shown in Fig. 1. (2) Leader pins cannot be made strong enough to resist uneven side filling. Much will depend on the proper location and preheating of the charge and the pressure used to fill the mold. Such a mold would hardly ever be designed of the flash type as shown on the left but could be of the semipositive type with shallow trapping chamber with all around clearance for overflow escape. What really becomes necessary is a box fit deep enough to insure its engagement before high pressure is applied, with overflow grooves all around the periphery of the box.

A closed single cavity mold with side gate as shown in Fig. 2 presents a similar problem. In this case an inverted and tapered boxing may be preferable. It must be assumed in this case that for some reason or another a central gate is not practical.

Alignment between mold halves will also depend on the guiding conditions of the press. While a press is no doubt at its best when it is new, a certain clearance must be provided for working tolerance and thermal expansion. On presses with horizontal travel, and especially of the tierod type, there is a drop of the moving platen when clamping pressure is released. This is caused by the weight of the platen, the weight of the mold half, fastened to this platen, the clearance between the tierod diameter and the platen bushings, plus the relaxed condition of the tierods. This drop may cause a pinch on the lower plastic walls of the part which becomes worse when the cavities are long in the direction of mold travel, if the coring is deep and if the plastic walls are thin with little or no draft. Much assistance can be obtained from strong rigid leader pins adequately mounted in the mold base. Their engagement should be long enough to insure the full clearing of the part from cavity or core. The length of the leader pin drive fit should be proportional to its engagement length and walls around the drive fit should be



COMPRESSION
FIG. 1

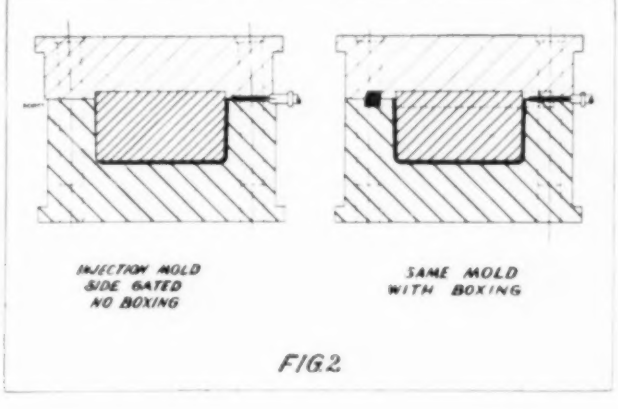
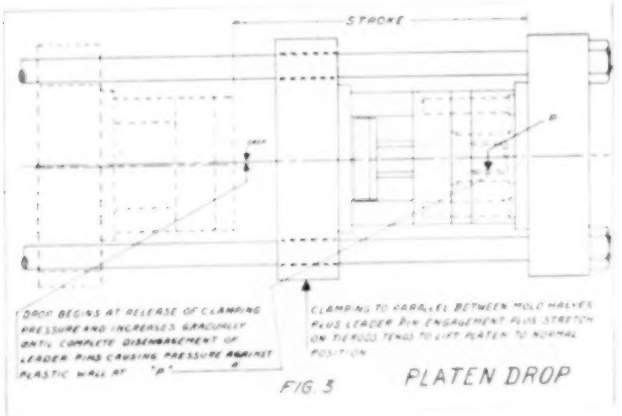


FIG. 2

heavy enough to insure against permanent ovalizing or temporary spring of its retaining hole. Probably the very best guiding action is required when the parts to be molded are not only long with deep coring but which require engaged frail and rigid zero fits between core tip and cavity bottom. In this case the slightest drop may cause serious breakage.


STROKE
DROP BEGINS AT RELEASE OF CLAMPING PRESSURE AND INCREASES GRADUALLY UNTIL COMPLETE DISENGAGEMENT OF LEADER PINS CAUSING PRESSURE AGAINST PLASTIC WALL AT "P"
CLAMPING TO PARALLEL BETWEEN MOLD HALVES PLUS LEADER PIN ENGAGEMENT PLUS STRETCH ON TIE RODS TENDS TO LIFT PLATEN TO NORMAL POSITION
FIG. 3 PLATEN DROP

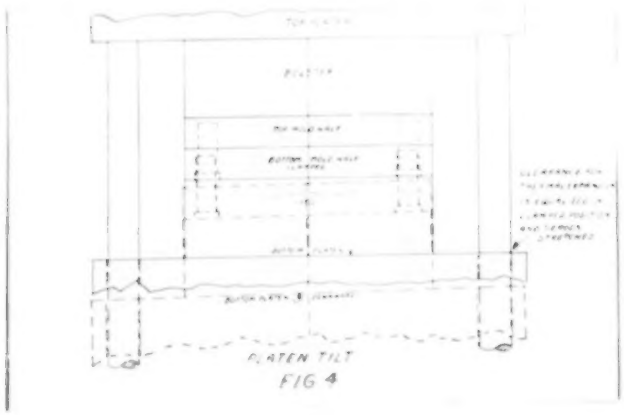
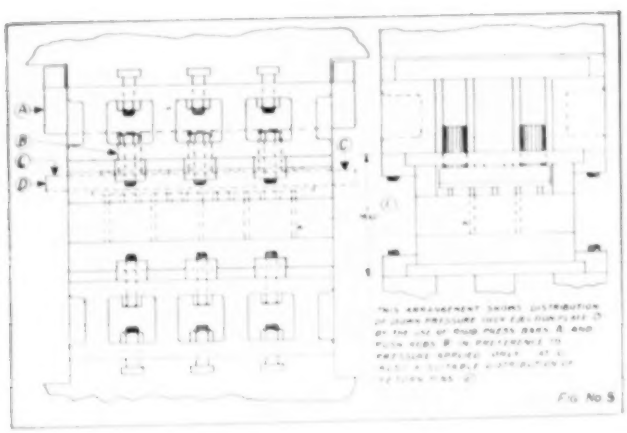


FIG 4



What is true for horizontal mold travel is also a factor on vertical mold travel especially on fully hydraulic presses of the tierod type intended for thermosets. More allowance has to be made for thermal expansion and bushing wear will be greater due to higher abrasive condition. In this case the mold has to deal with platen tilt shown in Fig. 4. This tilt increases with the distance between the tierods and the force required to level off the platen increases with the weight of the crosshead and moving half. Naturally less force is required to correct platen tilt by leader pin engagement than is required to compensate for platen drop, but more severe conditions in the molding of thermosets tend to cancel this advantage.

As a final thought about alignment between mold halves it must be remembered that the best press and the best mold cannot overcome deflection caused by unbalanced fill on slender cores.

EJECTION

Ejection has mostly to do with better level control of the **ejector** pin areas on the molded part and possibly even more so with the costly maintenance of this particular portion of the mold. It is no doubt a greater problem on thermosets because the mold is hot while under filling pressure. This means that the plastic will find its way into the closest fits and usually remains there. This causes tight fits which will exert considerable pressure against the ejector plate during ejection and considerable pull against the retainer plate during return. It may also cause long slender pins to take a permanent bend or an objectionable spring during the push-out period which tends to score or wear the pin and the hole. What also contributes to all this is the pressure to eject the part itself. On long ejector plates it may cause a momentary bow effect or a permanent bend which in turn causes more trouble. Because the pressure required to move the pin back may be greater than the molding pressure on the pin area it may not fully return, especially if the ejector plate does not remain straight. To greatly reduce all these troubles in advance a few points should be made the rule in design and moldmaking.

RULES FOR MOLD DESIGN

1. Use thickness proportional to length and area of ejector plate and a heat treated ejector plate for large areas with many pins.
2. To apply the push and pull pressure with equal distribution in area of long ejector plate rather than only at extreme left and right ends. See Fig. 5.
3. To guide the ejector plate on rigid dowels if necessary to make up for weight of ejector bar assembly on horizontal motion and possible lateral pull on clamped ejection systems.
4. The use of hard-surfaced ejector pins with tough core hardness.
5. The smooth lapping of ejector pin holes.
6. Close fits between pin and hole.
7. A bearing length about one and a half times the diameter. See Fig. 6.
8. A diametral relief of 1 64 on the cavity or core and another 1 64 on the pressure plate.
9. A slightly dulled edge at **in** end of ejector pin bearing.
10. A straight pin.
11. A good flat shouldered head inside the retainer plate.
12. A closely controlled counterboring depth for the head.
13. An accurately located pin retaining hole.
14. Pins longer than 24 times their diameter should

be avoided, especially for thermosets. Usually this can be done by restricting the necessary small diameter length to required ejection stroke plus 2-½ diameters. 1-½ diameters for the bearing length and one for clearance. The balance of the pin length can then be made larger in diameter. It may cost a little more but usually pays off.

15. A 60° countersink at entrance of hole in pressure plate and not more than 120° angle where relief meets the bearing diameter. This is necessary for easy assembly and prevents damage to the business end of the pins.

16. Insured parallelism of the ejector plate during travel. This is one point that cannot be controlled on the mold except at great expense. It becomes a function of the press and it may be said that in general there is room for improvement.

SUPPORTING AND RESISTING PRESSURE

Practically every mold for plastics has to deal with two types of pressure. In order to differentiate between the two it can be said that supports deal with pressures in the direction of mold travel and that resistance to pressure deals with lateral pressures which tend to expand cavities.

Supports represent the following portions of a mold: the back of the core and the back of the cavity, the pressure plates which back the core and cavity, the main side supports, the center supports or pillars across the gap provided for the ejector plate and the clamping plates. On closed molds before fill the area representing the main side supports should be adequate to oppose the possible maximum clamping pressure and the center supports should be adequate to oppose the entire unrelieved cavity area, based on the possible maximum plastic pressure required. See Fig. 7.

On open molds before fill much the same applies but it must be remembered that the lands or flash areas are subjected to the greatest pressures, particularly on materials containing cord or rag fillers. It must be kept in mind as well that because the areas representing the main side supports are not clamped during fill they do not offer as rigid a bridging on each side of the ejector plate gap. Depending therefore, on filling and cut off pressures required, an open mold may need more adequate center supports than the closed one. Another point to keep in mind is that when such a mold is intended for a press with centralized pressure its maximum capacity should be used for safety because pressure adjustments are not as dependable as on presses of the self-contained type.

Supports in a general way depend on the compressive strength of the mold materials. Space is often limited, especially for center supports. In such cases much can be accomplished by the use of heat treated steels. Another factor which should be remembered is that long center supports in proportion to their pressure area may spring or bend if overloaded during the pressure period without leaving a trace of any shortening when measured without pressure.

Resisting pressure has to do with the strength and rigidity of the cavity wall or its retainer. A round cavity is by nature the strongest as the circumference lines must actually stretch before it can expand. The farther the shape of the cavity deviates from the round, the more localized the effects of pressure become. If the thickness of the long walls of a rectangular cavity should be equal to the round one as shown on a comparative basis in Fig. 8, the walls would spring out under filling pressure and cause a very objectionable pinch on the plastic wall after pressure has been released. It would cause a very high mold opening load, an oversize wall thickness and may spoil the finish of the part. Plastic materials such as styrene are particularly sensitive to such a pinch and in some cases the slightest mold spring will be objectionable, especially on thin walls. If the mold is closed before fill much assistance can be obtained from tapered and inverted boxing which at the same time will make for better alignment between cavity and core.

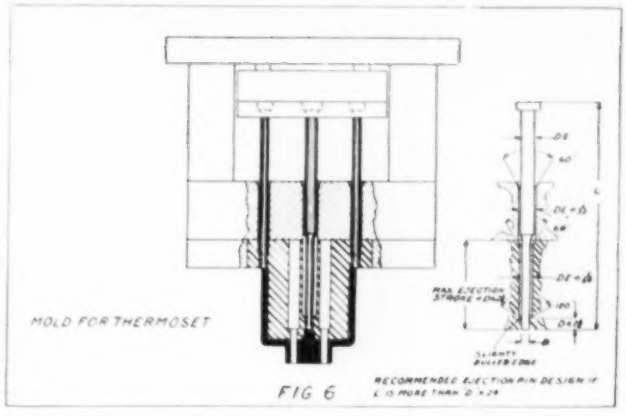


FIG 6

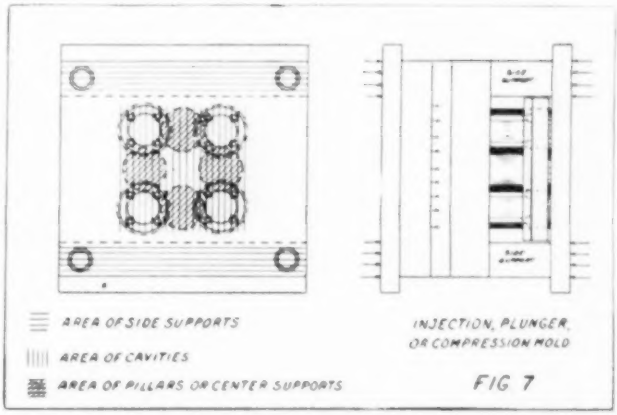


FIG 7

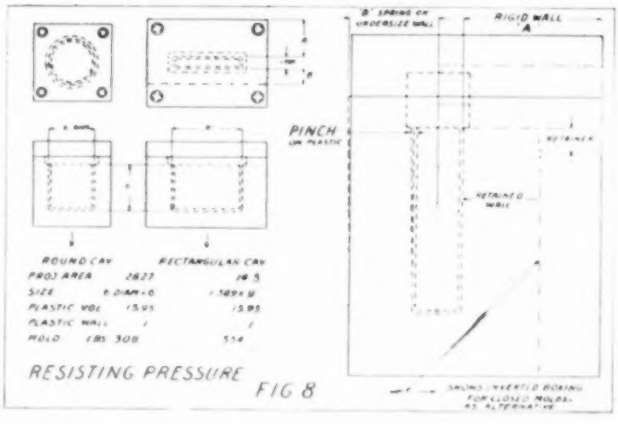
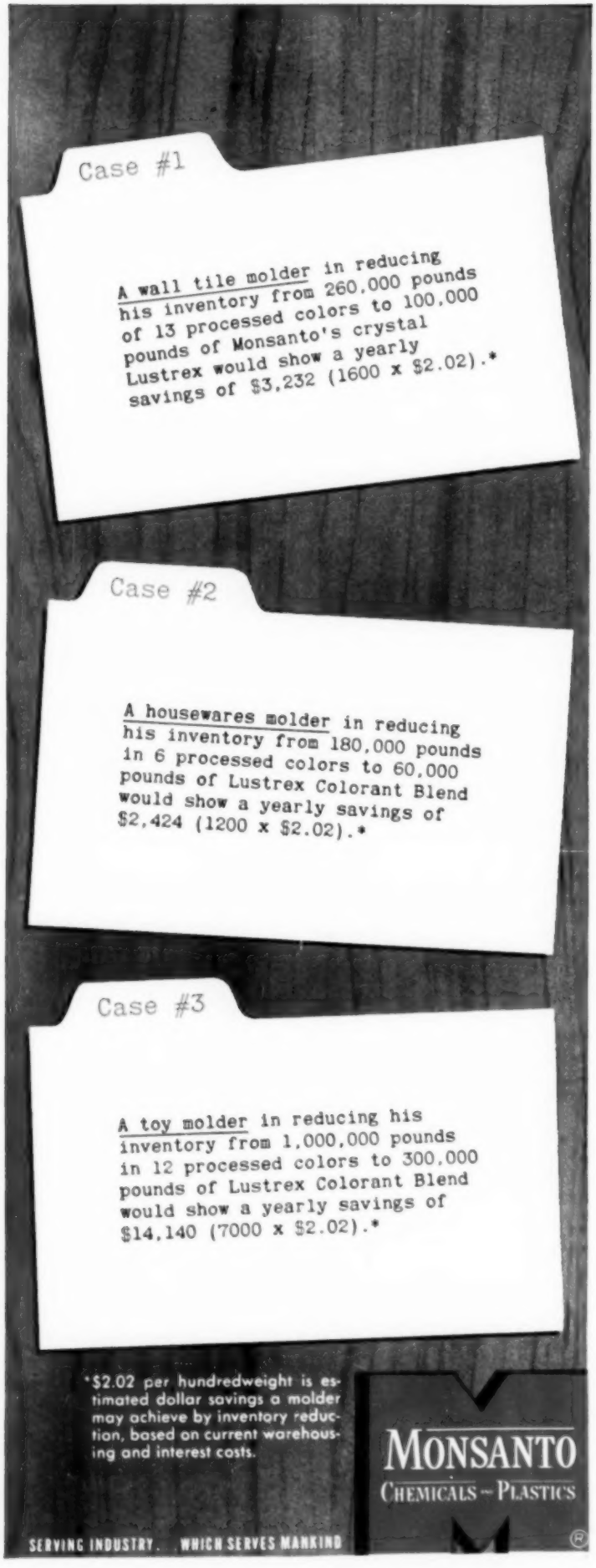


FIG 8

New Dillon-Beck Officers

Dillon-Beck Manufacturing Co. of Hillside, New Jersey, have appointed the following new officers:

President—J. Parke Logan
Vice-President—Charles B. Sanders
Vice-President, Manufacturing—Richard R. Lowe
Secretary-Treasurer—William E. Selby, Jr.


Case #1
A wall tile molder in reducing his inventory from 260,000 pounds of 13 processed colors to 100,000 pounds of Monsanto's crystal Lustrex would show a yearly savings of $3,232 (1600 x $2.02).*
Case #2
A housewares molder in reducing his inventory from 180,000 pounds in 6 processed colors to 60,000 pounds of Lustrex Colorant Blend would show a yearly savings of $2,424 (1200 x $2.02).*
Case #3
A toy molder in reducing his inventory from 1,000,000 pounds in 12 processed colors to 300,000 pounds of Lustrex Colorant Blend would show a yearly savings of $14,140 (7000 x $2.02).*
*$2.02 per hundredweight is estimated dollar savings a molder may achieve by inventory reduction, based on current warehousing and interest costs.
MONSANTO
CHEMICALS—PLASTICS
SERVING INDUSTRY . . . WHICH SERVES MANKIND

Big inventory savings

Many save over $2,000 a year dry coloring LUSTREX Colorant Blend Styrene

Stockpiling a half a dozen or a dozen shades of styrene is expensive business, considering warehousing costs and interest charges on capital invested in material.

That's one big reason so many leading molders have switched to dry coloring their own Lustrex Colorant Blend *crystal* styrene. They've discovered that by dry coloring you can reduce your inventory by as much as 75% . . . yet have any shade of styrene you want on a few minutes' notice.

The molder who can cut back his styrene inventory 100,000 pounds a year can save well over $2,000 (based on conservative estimates of current warehousing and interest costs). On larger operations, the savings easily swell into five figures.

More than this, dry coloring Lustrex Colorant Blend frees your capital for other jobs . . . increases the flexibility of your operation . . . reduces worry over materials shortages and or delays . . . and eliminates the problem of disposing of stock in unwanted or obsolete colors

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Room 2903, Springfield 2, Mass.

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Name & Title

Company

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City, Zone, State

Plastigels . . .

Production and Uses

Edward T. Severs
Bakelite Fellow, Mellon Institute

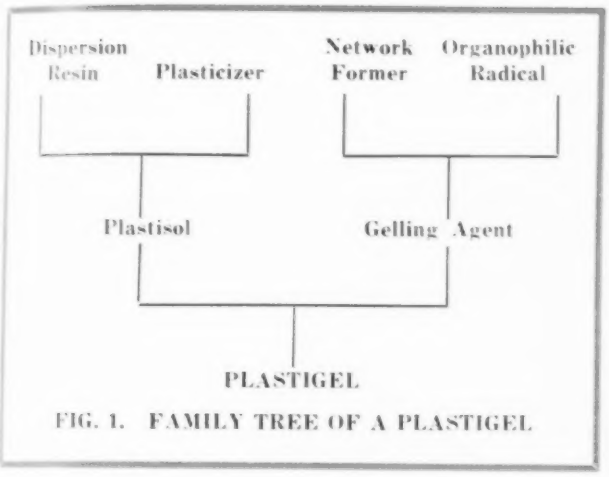

FIG. 1. FAMILY TREE OF A PLASTIGEL

THE PARENTS OF every new born son often, perhaps jokingly, expect him to one day become President. As the boy grows and his characteristics become more apparent, the parents become more realistic and are satisfied when their offspring performs that function in the world best suited to his talents. It is the same with the infant plastigel. It will serve best in the world of plastics in applications suited to its special characteristics.

A critical examination of any person usually begins with a discussion of his ancestry. Let us consider the family tree of a plastigel as shown in Fig. 1. The mother of a plastigel is a plastisol, which is formed by dispersing vinyl resin in a plasticizer. "Vinylite" resin QYNV is a typical resin used for this purpose. Visually, it is a white fluffy powder; but microscopically, it consists of small spheres approximately one micron in diameter. When a liquid plasticizer is stirred into the resin a paste-like liquid results, which is termed a plastisol. Heating the plastisol in the range of 300 to 350 deg. F. converts it to an elastomeric mass as the plasticizer solvates the particles of resin.

Plastisols may be applied to surfaces by knife spreading, roll coating, dip coating and slush molding techniques. Plastisols have proved themselves worthy members in the family of plastics.

If a plastisol is the mother of a plastigel, then the gelling agent is the father. Gelling agents used in forming plastigels usually consist of a network former coupled with an organophilic radical. A typical gelling agent is "Bentone" 34. The characteristic network structure of bentonite has been converted from hydrophilic to organophilic by reaction with alkyl amines. The long alkyl

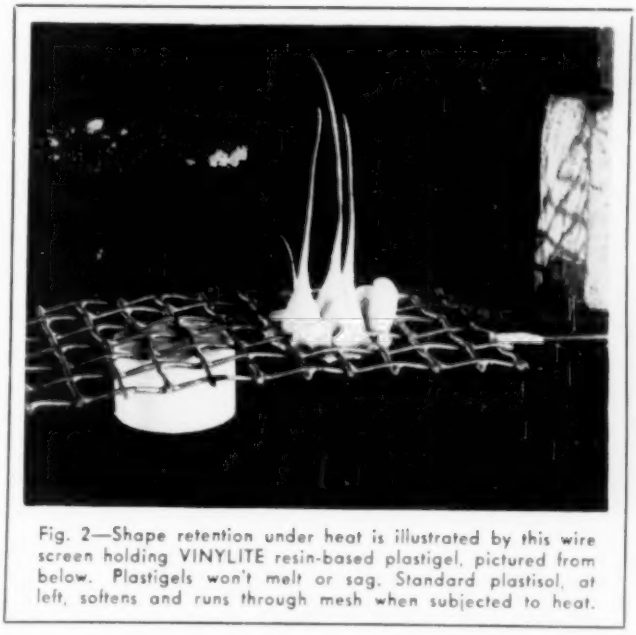

Fig. 2—Shape retention under heat is illustrated by this wire screen holding VINYLITE resin-based plastigel, pictured from below. Plastigels won't melt or sag. Standard plastisol, at left, softens and runs through mesh when subjected to heat.

chains allow the "Bentone" 34 to gel organic liquids in a manner analagous to the gelling of water by bentonite. Basic metallic soaps such as Napalm are also gelling agents for organic liquids, and their military use for gelling gasoline is well known. Napalm converts liquid gasoline to a stringy gel which spreads easily onto a surface and yet, when ignited, burns without flow. The gel structure is maintained even at the high temperatures of combustion. Similarly, "Bentone" 34 will gel plastisols to form plastigels. As the gelling agent is stirred into the plastisol, the free flowing properties rapidly disappear and are replaced by the putty-like consistency of a plastigel. The gel structure of the plastigel persists even at temperatures necessary for fusion. The retention of shape of a plastigel, compared with the softening of a plastisol, is shown in Fig. 2. A cylinder of plastigel did not melt or sag while a plastisol ran through the supporting screen when subjected to 350 deg. F. for 15 minutes. This maintenance of form during fusion is the most valuable property possessed by plastigels.

Formulation

Dispersion resin, plasticizer, and gelling agent are the essential ingredients of a plastigel. Hardness, low temperature flexibility, performance, and other ultimate properties may dictate the type and quantity of plasticizer used.

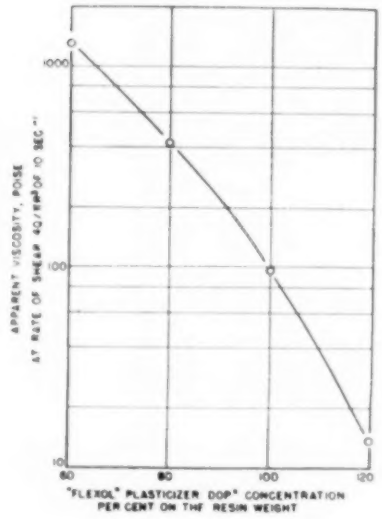

Fig. 3—Effect of plasticizer concentration on viscosity of plastigels.

Composition	Parts by Weight
VINYLITE Resin QYNV	100
"Bentone" 34	5
"Flexol" Plasticizer DP*	as indicated

*Di-2-Ethylhexyl Phthalate

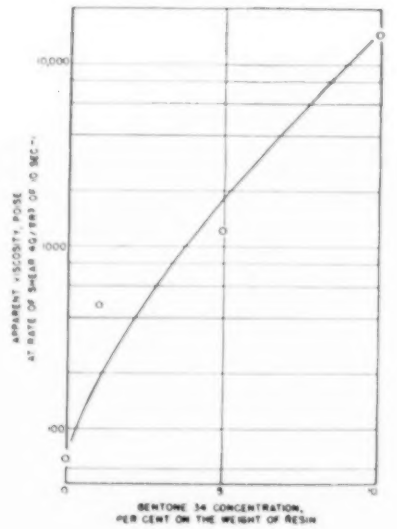

Fig. 4—Effect of gelling content on viscosity of plastigels

Composition	Parts by Weight
VINYLITE Resin QYNV	100
"Flexol" Plasticizer DOP	60
"Bentone" 34	as indicated

This choice is similar to that required for an ordinary plastisol and is covered in existing literature. A plastigel may be made quite flexible, or hard depending on the concentration of plasticizer.

Having fixed the plasticizer concentration, it is then necessary to formulate the plastigel to achieve flow properties required by the particular method of fabrication. Viscosities of plastigels at high and low rates of flow may be determined using an extrusion rheometer.

Data obtained using this rheometer indicate the viscosity of plastigels decreases rapidly with plasticizer concentration as shown in Fig. 3. Gelling agent concentration has the opposite effect as shown in Fig. 4. The viscosity of plastigels increases rapidly with concentration of gelling agent. This means that we can obtain the desired viscosity of a plastigel having a given plasticizer concentration by adjusting the concentration of gelling agent. Plastigels with low plasticizer content require relatively small amounts of gelling agent, while plastigels with high plasticizer content require relatively large amounts of gelling agent.

Preparation

Plastigels may be prepared with equipment normally used for the production of paints or specialty coatings. Plastigels using VINYLITE resin VYNV.2 are prepared by blending all the ingredients in a mixer. This mix is then "refined" on a 3-roll paint mill to form the plastigel. The use of VINYLITE resin QYNV simplifies the procedure since a plastigel is formed by simply mixing all the ingredients. In this case, pigments should be well dispersed in a portion of the plasticizer to develop their full color intensity and to prevent streaking. Gelling agents such as organophilic bentonites and colloidal silica should be dispersed in a manner similar to the pigments and metallic soaps and should be heated with a portion of the plasticizer to obtain maximum gelling efficiency.

Freshly prepared plastigels are more mobile than those which have aged undisturbed for several hours. This is a decided advantage since less power is required to mix plastigels of high ultimate consistency.

The formulator of plastigels may wish to add additional ingredients to his potpourri in order to obtain certain characteristics. The colorants designed for use in vinyl

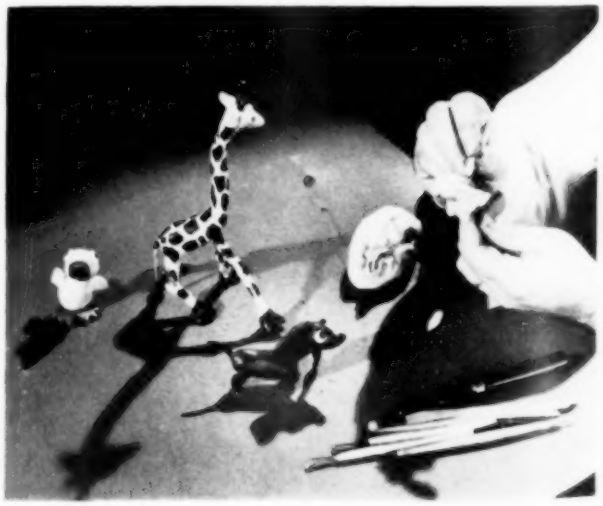

Fig. 5—Easily molded—at room temperature—VINYLITE resin-based plastigels can be worked by hand. They begin to stiffen when at rest, and retain shape, dimension and detail even while fluxing. The use of supports is required only for heavy or long sections.

resins may be used to obtain a variety of colors. Fillers such as whiting may be used as extenders, and fillers such as talc decrease surface tackiness in the unfused state. Stabilizers are added to reduce degradation by light or heat. The wide range of formulating possibilities inherent in plastigels should delight even the most critical of formulators.

Hand Modeling

Plastigels may be worked by hand into a variety of objects, and then fused in an oven at approximately 350 deg. F. Kitchen ovens operating at cake baking temperatures have been used for fusing plastigels. A little talc applied to the hands prevents sticking just as a baker dusts his hands with flour. When two parts of an object are to be joined, an ordinary plastisol is a good adhesive. The plastisol will fuse with the plastigel and produce a joint as strong as the material. Examples of hand modeled objects are shown in Fig. 5. Internal armatures or supports are required only for cantilevers or beams so long or heavy that the strength of the gel is exceeded.

Plastigels for modeling can be formulated by testing the consistency of various compositions with finger pressure. However, a quantitative measure of the consistency may be obtained by pressing a cylinder of plastigel between glass and measuring the diameter of the flattened cylinder. The softer the plastigel the larger will be the diameter of the cylinder after pressing with a load. The effect of both gelling agent and plasticizer concentration on the consistency of plastigels is shown by Fig. 6. Increased concentrations of plasticizer require increased concentrations of gelling agent in order to maintain a given consistency.

The consistency of a plastigel is altered by the magnitude of the shearing forces and also the duration of such forces. The consistency of a lump of plastigel will decrease on kneading and continue to decrease to a certain limit as long as the kneading continues. This is illustrated by Fig. 7. The diameter of a pressed cylinder increases with time of kneading. After the kneading is stopped, the plastigel slowly regains its original consistency.

The consistency test serves as a valuable tool in evaluating compositions for hand modeling and helps the formulator and customer to specify various degrees of stiffness.

Molding

Hand modeling of plastigels is satisfactory for art objects and custom-made articles. Where a large number of objects must be produced, or an exact shape must be formed, molding is more advantageous. The low pressures required for molding plastigels increases the materials available for mold construction. Molds may be made of plaster, or even of a flexible plastigel. Rubber latex as well as steel has been used for the construction of molds for plastigels.

One of the best release agents is a film of water containing a surface active agent. Talc and silicone emulsions also improve the mold release of plastigels. The mold surface is also a factor in the release of plastigels. Better release is obtained from matte surfaces than from those highly polished since air can channel along the rougher surface and break any vacuum created during release.

The release of plastigels is also a function of the magnitude and duration of the molding pressure. Faster cycles and lower pressures lessen the tendency of plastigels to soften to the point where adhesion by tackiness is objectionable. Plastigels may be ejected from molds by a gentle air stream to avoid mechanical distortion.

Objects molded of plastigels may be fused in an oven or in a hot liquid bath to make their molded shape perma-

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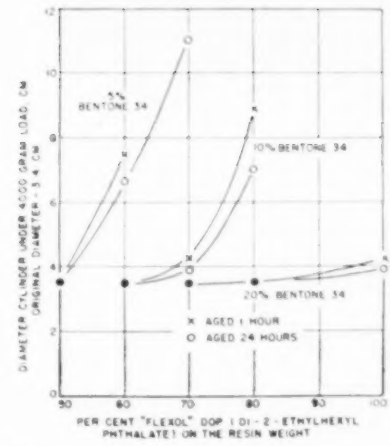

DIAMETER CYLINDER UNDER 4000 GRAM LOAD, CM
ORIGINAL DIAMETER - 3.4 CM
5% BENTONE 34
10% BENTONE 34
20% BENTONE 34
X AGED 1 HOUR
O AGED 24 HOURS
PER CENT "FLEXOL" DOP (DI-2-ETHYLHEXYL PHTHALATE) ON THE RESIN WEIGHT

Fig. 6—Effect of plasticizer and gelling agent content on consistency of plastigels.

Composition	Parts by Weight
VINYLITE Resin QYNV	100
"Dyphos"	2
"Flexol" Plasticizer DOP	50-100
"Bentone" 34	5-20

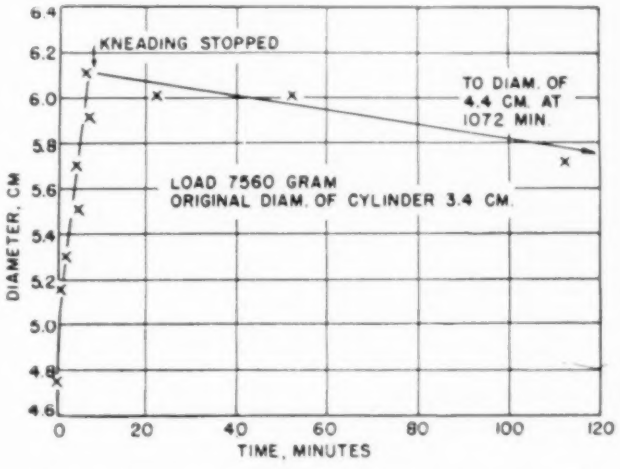


Fig. 7—Thixotropy and Recovery of a plastigel as measured by consistometer.

Composition	Parts by Weight
VINYLITE Resin QYNV	100
"Flexol" Plasticizer DOP	25
"Flexol" Plasticizer TOF	25
York Whiting	50
"Bentone" 34	5

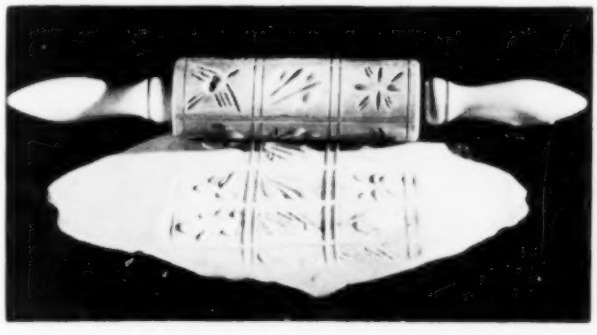


Fig. 8—Low pressure, heatless embossing is shown by the use of an intaglio rolling pin. VINYLITE resin-based plastigel also melts readily, picks up and holds fine details, retaining them during subsequent fusing processes. This sheet will be tough, flexible and wear resistant.

A Statistical Study of

R. E. Colwell
Monsanto Chemical Co.

A Technical Symposium Paper Presented at the Ninth SPE Conference

Extrusion is an important operation in both the plastics manufacturing and plastics fabrication industries. There are many problems which are common to the two industries, but often the magnitude of the particular problem differs. For example the plastics manufacturer may control his extrusion operation to obtain optimum coloring, particular physical properties, and high rates of thru-put. Of greater concern to the fabricator may be the control of the physical dimensions of the extruded object. It is more difficult to correlate those factors that control the quality of extrusion than the factors which determine rate of extrusion, power consumption, and material temperature because one must assign arbitrary scales to the quality factors.

THE PURPOSE OF this paper is to show by example how one can use statistical techniques to study the many extrusion variables. The results of a plant scale experiment involving ten variables are reported and analysed. Since this data pertains to an existing process which is not being described at this time the absolute values of the data have been coded. The trends and relationships between the variables are as reported in this paper. Such information may aid in the formulation of an extrusion theory.

The approach to the problem is empirical rather than theoretical. The treatment of quality factors is by means of discussion only; quality data are not presented. A method for studying such factors is described.

Review of Statistical Methods Used

The design of experiments can be made more systematic by the use of statistical aids. This subject has been treated in detail by Brownlee (1), Davies and Hay (3), Johnson (6), Kempthorne (7), and other authors. The factorial design or fractionally replicated factorial design has been found most useful in this work. Slide (1) shows an arrangement of 16 experiments involving four variables each at two levels. The full set of 16 experiments is called a factorial design. There are 15 possible comparisons one might make among these variables and all 15 can be made with validity when the 16 experiments have been completed. The eight blocks either with crosses or the remaining eight blocks without crosses comprise a one half replicated factorial design. Again one might wish to make all 15 comparisons but since only eight experiments are run one can make only seven comparisons and each of these has an alias. That is, the variance may be caused by either of two effects. Unless one has other data which will permit him to discriminate between the two possibilities, a clear cut answer is not obtained. The usual assumption is that the main variables are sources of variance rather than the three factor interactions which are their aliases in this particular arrangement. With a more complex design one can evaluate two and three factor interactions even though a fractional replicate design is used, that is when only a fraction of the possible experiments are conducted.

Harrington (5) has presented an interesting and descriptive technique for visualizing the actual comparisons which one might wish to make. This is shown in slide (2). Again the sixteen experiment factorial design is used. The main effect of a particular variable is determined by comparing the two levels of that variable. In the plus and minus diagrams one compares the data for the plus boxes with the data for the minus boxes. In these diagrams the pluses are the lower level of the variables and the minuses are the higher levels. If one knows what comprises a significant difference between such numbers he may immediately interpret his results. Otherwise the conventional analysis of variance, which permits one to discriminate between differences resulting from random errors and unknown causes, must be performed. The single factor plus and minus diagrams can be written by inspection from the factorial design. This is also true for the fractionally replicated design. To obtain the plus and minus diagrams for the two, three, and four factor interactions one need only to multiply the signs of the corresponding blocks of each of the pertinent single factor plus and minus diagrams. A block is a single position in any of the diagrams. Thus to get the ABC three factor interaction comparison consider the A, B, and C single factor plus and minus diagrams. For block 1, row 1 of the ABC interaction multiply block 1 row 1 of each of the single factor plus and minus diagrams. That is (plus) (plus) (plus) = (plus) for block 1 row 1 of the ABC interaction. For block 2 row 1 we have (plus) (minus) (plus) = (minus), etc.

This development has been repeated here to help explain what is meant by an interaction. The plus and minus diagrams show what experiments to compare to measure the interaction. A further example should help to remove any doubt as to the physical significance of these comparisons.

Slide (3) illustrates this example. Extrusion rate is the ordinate and screw RPM the abscissa. If screw 1, the reference extrusion screw, is compared with screw 2 the

Extrusion Variables . . . .

increase in extrusion rate with increasing RPM is identical. That is, both lines have the same slope. The absolute value of extrusion rate is higher with screw 2 which indicates that there is a difference between the screws. The difference is not dependent upon the screw RPM. There is no interaction. If one compares screw 3 to screw 1 he finds that at low RPM the rates are equivalent, but at high RPM screw 3 rate is greater. In this case one would expect to find both main effects (screw and speed) significant sources of variance and in addition the interaction between screw and RPM would be a significant source of variance. Finally one can compare screw 4 with screw 1. In this case the interaction has completely obscured the main effect of the screw. Only the interaction between RPM and screw is a significant source of variance. In general three factor interactions are uncommon and many statisticians use the three or four factor interactions as a measure of experimental error.

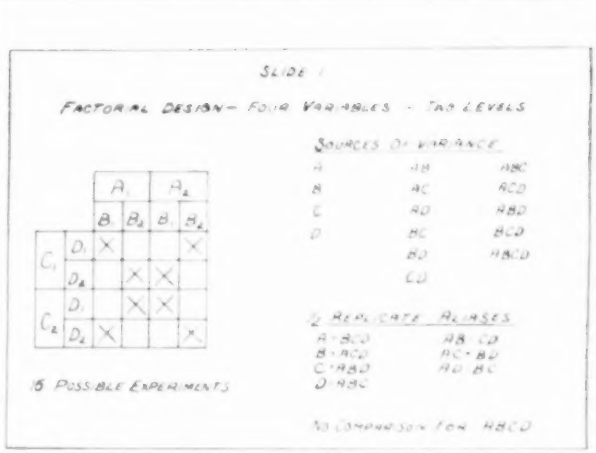
There is another statistical technique which is of special interest when one must correlate data pertaining to the quality of extrusion. First it is necessary to classify the data in accordance with some arbitrary scale. The scale need not be uniform. The interpretation of such data using the **Analysis of Variance by Rank** (8) is rapid, qualitiative, and surprisingly accurate. It is possible to detect interactions and to determine the optimum mode of operation from such data.

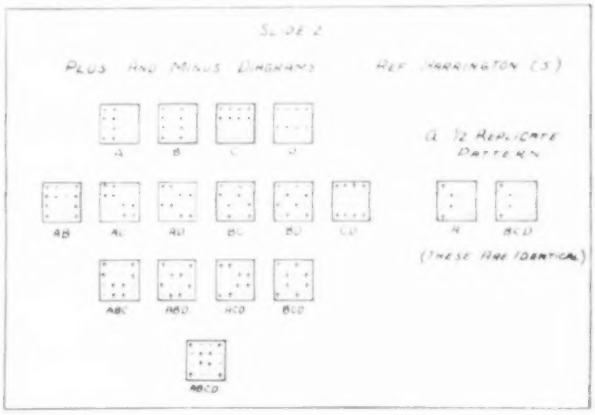
It is relatively easy to generalize the interpretation of a set of data. The tendency towards excessive generalization, even beyond the limitations of the particular experiments, is not uncommon. One advantage of the statistical approach is that the degree of uncertainty is established. By the use of statistical techniques one can reduce the expenditure of both time and money for experimentation to a minimum consistent with the accuracy required.

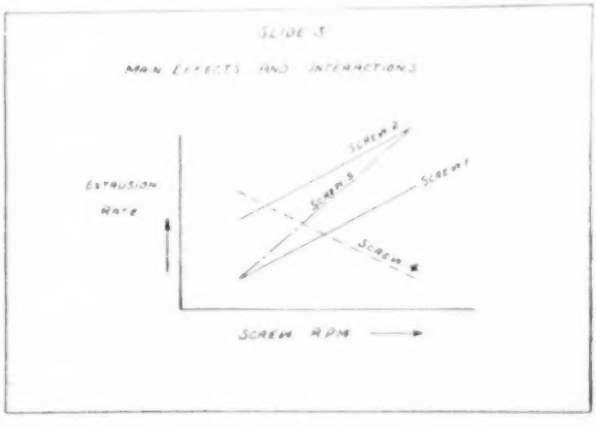
Review of Extrusion Theory

Gore (4) and associates presented an excellent series of papers on extrusion theory and extrusion studies dealing primarily with the extrusion of a melt. Additional work by the same group is being presented at this meeting.* Contributors to an extrusion theory include Pigott (9), Rogowsky (10), Rowell & Finlayson (11), Strub (12) and others. Most investigators have chosen to study idealized systems wherein the variables were defined analytically. As yet no one has presented a general theory involving all the pertinent variables associated with a plastics extruder. This is not surprising when one realizes that 10 or more variables may be involved, some of which can not be expressed in absolute units.

The usual assumption of a constant coefficient of friction is certainly subject to criticism when one considers the plastics extruder processing a solid granular feed material. Assumptions relative to the flow distribution within the extruder are highly uncertain except in idealized cases. In some operations the particular flow pattern realized may determine the success or failure of







the process. Such is the case for extrusion coloring. It is beyond the scope of this paper to formulate an extrusion theory. We do not presume to know how many of the factors are related analytically, but we have succeeded in

(Please turn to Page 67)

*Ninth Annual National Technical Conference of the SPE, Jan. 1953, Boston, Mass. See SPE Journal, March 1953.

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Eastman Chemical Products, Inc.
360 N. Michigan Ave., Chicago, Ill.

BEVERLY, A. LEO
4220 Hohman Ave., Hammond, Ind.
(Great Lakes Manufacturing Corp.)

BEZARK, RICHARD S.
Superior Plastics Div.
Commonwealth Plastics
426 N. Oakley, Chicago, Ill.

BJORKSTEN, JOHAN
Bjorksten Research Laboratories, Inc.
523 W. Gorham St., Madison, Wis.

BLACKWELL, STANLEY R.
Quality Molding Co.
3741 W. Diversy Pl., Chicago, Ill.

BOEBINGER, ELBERT J.
The Richardson Co.
2700 Lake St., Melrose Park, Ill.

BORRO, EDWARD, F., JR.
Borro Plastics & Chemicals, Inc.
221 N. LaSalle St., Chicago, Ill.

BRAND, FRANK C.
Grove Tool & Die Co.
4725 Belmont Rd., Downers Grove, Ill.

BRANDT, HERMAN WILLIAM
Plastic Molded Products Co.
6044 N. Pulaski, Chicago, Ill.

BRITTENHAM, CHARLES H.
Square D Company
Peru, Ind.

BROTZ, FRANK M.
Plastics Engineering Co.
1607 Geele Ave., Sheboygan, Wis.

BROTZ, RALPH T.
Plastics Engineering Co., Inc.
1607 Geele Ave., Sheboygan, Wis.

BROTZ, ROMAN C.
Plastics Engineering Co., Inc.
1607 Geele Ave., Sheboygan, Wis.

BROWN, WILLIAM FREDERICK
Bakelite Co., Div. of UC&C Corp.
230 N. Michigan Ave., Chicago, Ill.

BRUMMER, MILTON L.
3866 N. Merrimac Ave., Chicago, Ill.
(Rohm & Haas Co.)

BRYAN, ALBERT
Auburn Button Works
9 S. Clinton St., Rm. 704, Chicago, Ill.

BUCKMAN, CHARLES
7348 Ridge Ave., Chicago, Ill.
(Eclipse Manufacturing Co.)

BUDLONG, ROBERT D.
Rm. 1112, 333 N. Michigan Ave.
Chicago, Ill.

BUEROSSE, A. E.
Taycheedah, Wis.
(Wells Manufacturing Co.)

BURACK, ELMER H.
Chicago Molded Products, Corp.
7650 N. Kolmar, Chicago, Ill.

BUSH, LEON D.
4218 W. Diversey Ave., Chicago, Ill.

CADDELL, WILLIAM DAVID
5400 N. Monticello, Skokie, Ill.
(Wm. Caddell Assoc.)

CALEF, J. F.
Automatic Electric Co.
1033 W. Van Buren St., Chicago, Ill.

CAMPBELL, ROBERT H.
919 N. Michigan Ave., Chicago, Ill.
(R. H. Campbell Co.)

CARLSON, HENRY C.
Koppers Co., Inc.
Koppers Bldg., Pittsburgh, Pa.

CHEW, DONALD D.
Coffield-Stephens Associates
7720 N. Sheridan Rd., Chicago, Ill.

CHRISTENSEN, DELBERT L.
Flex-O-Glass, Inc.
1100 N. Cicero Ave., Chicago, Ill.

CLAGUE, ROBERT H.
R. H. Clague Co.
2302 W. Clybourn St., Milwaukee, Wis.

CLEAVENGER, THOMAS H.
7551 State Line St., Munster, Ind.
(Anesite Co.)

COCHRAN, DONALD J.
4457 W. Jackson Blvd., Chicago, Ill.

CONNORS, JAMES M.
Modern Plastics, Inc.
101 E. Ontario St., Chicago, Ill.

COOPER, WARREN F., JR.
Eastman Chemical Products, Inc.
360 N. Michigan Ave., Chicago, Ill.

COWAN, DAVID D.
Celanese Corporation of America
1514 Merchandise Mart,
Chicago 54, Ill.

CROISANT, E. H.
Synthane Corp.
Morton Grove, Ill.

DANIELS, RAYMOND ELKINS, JR.
4612 Grove St., Skokie, Ill.
(The Dow Chemical Co.)

DAVIS, ROBERT EDWIN
99 S. Main St., Mt. Gilead, Ohio
(The Watson-Stillman Co.)

DELI, FRANK D.
Amos Molded Plastics
1005 W. Belmont Ave., Chicago, Ill.

DONDY, D. L.
2413 W. Farragut Ave., Chicago, Ill.
(Monsanto Chemical Co.)

DOOLITTLE, H. A.
Stimsonite Plastics Div.
American Gas Accumulator Co.
3445 N. Kimball, Chicago, Ill.

DOUGHTY, GEORGE GILBERT
3429 Washington, Downers Grove, Ill.
(Improved Paper Machinery Corp.)

DOURLET, ERNEST FRANCIS
Rohm & Haas Co.
222 N. Michigan Ave., Chicago, Ill.

DUFFETT, N. B.
Bakelite Co., Div. of UC&C Corp.
230 N. Michigan Ave., Chicago, Ill.

DUNN, LLOYD P.
John Amann Sons Co.
5805 S. Oakley Blvd., Chicago, Ill.

DUNN, P. J., JR.
Celanese Corporation of America
1514 Merchandise Mart, Chicago, Ill.

ECKENBECK, EVERETT E.
2730 Thayer St., Evanston, Ill.
(Midwest Plastic Products Co.)

ECKENBECK, EVERETT E., JR.
2730 Thayer St., Evanston, Ill.
(Midwest Plastic Products Co.)

EDELSTON, JOSEPH
1335 Astor St., Chicago, Ill.
(Superior Plastics, Inc.)

EDGERTON, D. R.
Lindberg Steel Treating Co.
220 N. Laflin St., Chicago, Ill.

EDLIS, STEFAN T.
General Die Mold Co.
548 N. Sacramento Blvd., Chicago, Ill.

ERICKSON, HUGO S.
Industrial Molded Products Co., Inc.
5201 Avondale Ave., Chicago, Ill.

ERLEY, WALTER L.
18350 Kedzie St., Homewood, Ill.
(Rogers Corp.)

EVANS, LUTHER J.
Mayfair Molded Products Corp.
4440 N. Elston Ave., Chicago, Ill.

FEID, ROBERT A.
B & T Plastic Finishing Co.
6330 N. Clark St., Chicago, Ill.

FELSENTHAL, JAMES G.
G. Felsenthal & Sons, Inc.
4100 W. Grand Ave., Chicago, Ill.

FERGUSON, JAMES
Plaskon Div., L-O-F Glass Co.
400 W. Madison St., Chicago 6, Ill.

FIERI, A. J.
Moldrite Plastics
2000 W. Walnut St., Chicago, Ill.

FINA, PAUL E.
314 Herrick, Riverside, Ill.
(Fiberite Corp.)

FINE, FRANKLIN L.
Rohm & Haas Co.
222 N. Michigan Ave., Chicago, Ill.

FISCHER, ANDREW J.
4554 Broadway, Chicago, Ill.
(Andrew Fischer Associates)

FISHMAN, LOUIS
Fishman Plastics Co.
442 W. Garfield Blvd., Chicago, Ill.

FLANAGAN, JAMES
Neff Kohlbusch & Bissell
610 W. Michigan St., Milwaukee, Wis.

FORD, PAUL B.
7 E. Huron St., Chicago, Ill.
(Bauder, Baker, Inc.)

FORST, ERNEST
2443 Gunnison St., Chicago, Ill.

FOX, CYRIL B., JR.
Eastman Chemical Products, Inc.
360 N. Michigan Ave., Chicago, Ill.

FREEMAN, HANS
Creative Plastics Engineering Co.
1912 N. Milwaukee Ave., Chicago, Ill.

FRIBERG, THEODORE
National Lock Co.
1902 7th St., Rockford, Ill.

FROBERG, HAROLD E.
Colonial Kolonite Co.
2212 W. Armitage Ave., Chicago, Ill.

FUNK, LEE
953 W. Belmont Ave., Chicago, Ill.
(G. Felsenthal & Sons, Inc.)

FURHOLMEN, ERIK
70 S. Grace St., Lombard, Ill.
(Furnel, Inc.)

GEBHARD, HARRY W.
5129 W. Devon Ave., Chicago, Ill.
(Harry W. Gebhard Co.)

GIBSON, ARCH M.
5718 S. Kenwood Ave., Chicago, Ill.
(Plastics Engineering Co.)

GIDEON, WILLIAM P.
Eastman Chemical Products, Inc.
360 N. Michigan Ave., Chicago, Ill.

GITS, JOSEPH A.
1423 Bonnie Brae, River Forest, Ill.
(Gits Molding Corp.)

GITS, JULES P.
1410 Clinton Pl., River Forest, Ill.
(Gits Molding Corp.)

GLAESCHER, GORDON W.
National Vulcanized Fibre Co.
2808 W. Lake St., Chicago, Ill.

GOLDMAN, JOHN G.
5021 Dorchester Ave., Chicago, Ill.
(G. Felsenthal & Sons, Inc.)

GOSSETT, ROBERT KENNETH
Gossett & Hill Co.
3120 N. Cicero Ave., Chicago, Ill.

CHICAGO (cont'd.)

GREEN, WILLIAM E.
Owens-Illinois Glass Co.
P. O. Box 409, St. Charles, Ill.

GROESBECK, JOHN
U. S. Rubber-Chicago Die Mold Div.
4001 Wrightwood Ave., Chicago, Ill.

HADLEY, FRANK E.
Catalin Corporation of America
221 N. LaSalle St., Chicago, Ill.

HALVORSEN, JOHN J.
Crane Co.
836 S. Michigan Ave., Chicago, Ill.

HAMALA, ARNOLD T.
Pullman Standard Car Mfg. Co.
1414 Field St., Hammond, Ind.

HANNA, RUSSELL D.
Hercules Powder Co.
332 S. Michigan Ave., Chicago, Ill.

HANSEL, RICHARD J.
3544 N. Ottawa Ave., Chicago, Ill.
(Midland Die & Engraving Co.)

HART, WILLIAM A.
3807 S. Wesley Ave., Berwyn, Ill.
(American Standard Products Co.)

HECK, DANIEL C.
943 Webster Lane, Des Plaines, Ill.
(Crane Co.)

HECK, ERVIN R.
200 E. Dewey Ave., North Lake, Ill.

HEENAN, S. A.
Stimsonite Plastics Div.
American Gas Accumulator Co.
3445 N. Kimball, Chicago, Ill.

HELLER, L. B.
Sunlite Manufacturing Co.
317 S. 1st St., Milwaukee, Wis.

HELLIWELL, S. STEWART
F. J. Stokes Machine Co.
20 N. Wacker Dr., Chicago, Ill.

HEMINGWAY, FRANK L.
523 Wilshire Dr., Rockford, Ill.

HENNING, JAMES L.
Plano Molding Co.
Plano, Ill.

HENRY, CHARLES C.
6705 Caldwell Ave., Chicago, Ill.
(U. S. Rubber-Chicago Die Mold Div.)

HERBST, CLARENCE A.
Resinoid Engineering Corp.
3445 Howard St., Skokie, Ill.

HERRERA, DAVID E.
Greer Shop Training, Inc.
2230 S. Michigan Ave., Chicago, Ill.

HESS, WILLIAM L.
Anesite Co.
3575 W. Touhy Ave., Lincolnwood, Ill.

HICKS, JOHN F.
The Richardson Co.
2789 Lake St., Melrose Park, Ill.

HILL, MERTON E.
Gossett & Hill Co.
3120 N. Cicero Ave., Chicago, Ill.

HINCHSLIFF, WILLIAM E.
Breyer Molding Co.
2536 W. Lake St., Chicago, Ill.

HITCHCOCK, ARTHUR B.
Western Electric Co.
2525 N. Shadeland Ave., Indianapolis, Ind.

HOLLAND, MARVIN
4301 N. Springfield Ave., Chicago, Ill.
(M. Holland Co.)

HOWIE, J. L., JR.
The Grigoleit Co.
740 E. North St., Decatur, Ill.

HRUDKA, ROBERT F.
Bakelite Co., Div. of UC&C Corp.
230 N. Michigan Ave., Chicago, Ill.

HUEBNER, KENNETH C.
Glynn-Johnson Corp.
4422 N. Ravenswood Ave., Chicago, Ill.

HULTERSTRUM, HAROLD D.
Flambeau Plastics Corp.
501 7th St., Baraboo, Wis.

HULTGREN, ARNOLD P.
American Molded Products Co.
1644 N. Honore St., Chicago, Ill.

HUNT, CHARLES K.
307 W. 6th St., Hinsdale, Ill.
(University of Illinois)

JOHN, FREDERICK W.
523 S. Craig Pl., Lombard, Ill.
(Turner Manufacturing Co.)

JOHNSTON, JAMES E.
608 Beverly Lane, Arlington Hts., Ill.
(Chicago Molded Products Corp.)

JONES, CHARLES E.
Charles E. Jones & Associates, Inc.
189 W. Madison St., Chicago, Ill.

KAPPEL, HENRY CHARLES
The Richardson Co.
Melrose Park, Ill.

KARELS, CHARLES
6457 N. Damen Ave., Chicago, Ill.
(Service Plastics, Inc.)

KARELS, THOMAS R.
B & T Plastic Finishing Co.
6330 N. Clark St., Chicago, Ill.

KAZIMIER, HENRY A.
818 W. Sycamore, Kokomo, Ind.
(Modern Plastics Corp.)

KAZIMIER, J. C.
Amos Molded Products
405 S. Kyle St., Edinburg, Ind.

KELLY, WILLIAM L.
2240 W. 115th St., Chicago, Ill.
(Plas-Steel Products Co.)

KEMPF, JACOB A.
Steel Mill Products Corp
176 W. Adams St., Chicago, Ill.

KEOWN, EARL RAYNER
6643 Tower Circle, Chicago, Ill.
(Santay Corporation)

KERSEG, WALTER F.
203 Hillcrest Rd., Ogden Dunes
Gary, Ind.

KINSEY, ROY W., JR.
2416 Cowper Ave., Evanston, Ill.
(Victory Mfg. Co.)

KLEIN, HENRY C., JR.
Sunlite Manufacturing Co.
317 S. 1st St., Milwaukee, Wis.

KLEIN, IRVING N.
H. Muehlstein & Co., Inc.
4237 W. 42nd Pl., Chicago, Ill.

KOSOBUD, WILLIAM
Detroit Mold Engineering Co.
5315 W. Lake St., Chicago, Ill.

KRAKAU, A. (LOUIE)
5123 N. Newcastle Ave., Chicago, Ill.
(Acme Scientific Co.)

KRAMER, ERIC B.
Superior Plastics, Inc.
426 N. Oakley Blvd., Chicago, Ill.

KREHBIEL, J. H.
Molex Products Co.
400 N. Harding Ave., Chicago, Ill.

LANGE, WILLIAM F., JR.
Plastic Service Corp.
RFD #2, LaPorte, Ind.

LASSER, ALLAN L.
Tower Oil Co.
111 N. Canal, Chicago, Ill.

LEVIN, CARL
Powdered Metal Prod. Corp. of Amer.
9335 W. Belmont Ave., Franklin Park, Ill.

LIND, CARL J.
Lind Plastic Products, Inc.
6900 N. Central Pk., Chicago, Ill.

LIND, TED N., JR.
Lind Plastic Products, Inc.
6900 N. Central Pk., Chicago, Ill.

LINDAHL, FRED W.
Nixon Nitration Works
510 N. Dearborn, Chicago, Ill.

LONGACRE, WALTER B.
2214 Franklin St., Manitowac, Wis.
(Lakeside Plastics)

LOUER, JOHN C.
1837 S. 19th Ave., Maywood, Ill.
(Elmer E. Mills Corp.)

LOVGREN, ARTHUR FRED
6726 Schreiber Ave., Chicago, Ill.
(Carlson & Selman)

LUBIN, SIDNEY
American Plastic Manufacturing Co.
2938 N. Halsted St., Chicago, Ill.

MACK, JOHN
John Mack & Son Moulded Products, Inc.
6227 N. Broadway, Chicago, Ill.

MACK, JOHN, JR.
John Mack & Son Moulded Products, Inc.
6227 N. Broadway, Chicago, Ill.

MASSOPUST, C. F.
General American Transportation Corp.
135 S. LaSalle St., Chicago, Ill.

MATHEWS, THEOBALD M., JR.
P. O. Box 133, Plymouth, Wis.
(T. M. Mathews Co.)

MCCORMICK, CLARENCE
6899 N. Hiawatha, Chicago, Ill.
(Superior Plastics Co.)

MC CORMISH, W. E.
L. Albert & Son
120 S. LaSalle St., Chicago, Ill.

MELNICK, SIDNEY
G. Felsenthal & Sons, Inc.
4100 W. Grand Ave., Chicago, Ill.

MELTZER, MAURICE
6052 N. Troy, Chicago, Ill.
(Service Plastics, Inc.)

MELVIN, STANLEY R.
Monsanto Chemical Co.
1104 Merchandise Mart, Chicago, Ill.

MILLER, NELS A.
129 S. Harvey Ave., Oak Park, Ill.

MILLER, VICTOR A.
Plastic Masters, Inc.
W. Buffalo St., New Buffalo, Mich.

MILLS, ELMER E.
Elmer E. Mills Corp.
2930 N. Ashland Ave., Chicago, Ill.

MOLEN, FRANKLIN B.
Naugatuck Chemical Co.
2638 N. Pulaski Rd., Chicago, Ill.

MOORE, J. FRANKLIN
3925 N. Merrimac Ave., Chicago, Ill.

MOOY, RICHARD W.
3801 W. Addison St., Chicago, Ill.
(United States Rubber Co.)

MOREHOUSE, ROBERT H.
Kent Plastics Corp.
1528 N. Fulton, Evansville, Ind.

MOSAK, JOHN B.
Fullerton Plaza Hotel
420 Fullerton Parkway, Chicago, Ill.
(Nu-Dell Manufacturing Co.)

MUCKENFUSS, THOMAS F.
J. B. Products Corp.
1745 N. Ashland Ave., Chicago, Ill.

MUNRO, KENNETH E.
1112 Potter Rd., Park Ridge, Ill.
(Federal Tool Corp.)

NAGY, JULIUS J.
Sandee Manufacturing Co.
4659 Foster Ave., Chicago, Ill.

NEASE, ARLO D.
A & O Plastics Co.
1313 Warren Ave., Downers Grove, Ill.

NELSON, A. W.
Ruda Products Co.
2911 Carroll Ave., Chicago, Ill.

NELSON, MELVIN V.
Autopoint Co.
1801 Foster Ave., Chicago, Ill.

NEUMAN, JOHN
Nu Manufacturing Co.
1459 W. North Ave., Chicago, Ill.

NIELSEN, ERIK R.
7223 Sheridan Rd., Chicago, Ill.
(Armour Research Foundation)

NISSEN, J. O.
Monsanto Chemical Co.
1104 Merchandise Mart, Chicago, Ill.

OLSON, R. J.
Federal Tool Corp.
2600 W. Pratt Blvd., Chicago, Ill.

ORME, T. R.
Bakelite Co., Div. of UC&C Corp.
230 N. Michigan Ave., Chicago, Ill.

PALEN, JULIUS W.
45 Owana Ave., St. Clair, Mich.
(Standard Products Co.)

PANNHAUSEN, JOHN
American Phenolic Corp.
1830 S. 54th Ave., Chicago, Ill.

PARKS, LLOYD E.
Bee Chemical Co.
15709 South Ave. O., Chicago, Ill.

PERZAN, HARRY J.
Lee Tool & Engineering
2031 N. Parkside Ave., Chicago, Ill.

PETERSON, LLOYD A.
Stimsonite Plastics Div.
American Gas Accumulator Co.
2415 N. Kimball Ave., Chicago, Ill.

PETERSON, MILTON O.
216 W. Washington Pl., Freeport, Ill.
(Micro Switch Div., Minneapolis
Honeywell Regulator Co.)

PHILLIPS, RAYMOND F.
73 S. Westmore Ave., Lombard, Ill.
(Chicago Molded Products Corp.)

PIERCE, R. F.
2236 Park St., Terre Haute, Ind.
(The Visking Corp.)

PLOWRIGHT, ROBERT D.
609 Washington Blvd., Oak Park, Ill.

PORTE, N. H.
General American Transportation Corp.
135 S. La Salle St., Chicago, Ill.

PORTER, BENJAMIN T.
477 Oakdale, Glencoe, Ill.
(Catalin Corporation of America)

POUST, M. L.
2005 Banbury Rd., Kalamazoo, Mich.
(Fabri-Kal Corp.)

PREPELICA, THOMAS A.
Midwest Molding and Manufacturing Co.
4630 W. Fullerton Ave., Chicago, Ill.

PULS, FRED H.
Plastics Engineering Co.
1007 Geele Ave., Sheboygan, Wis.

PUTSEY, HAROLD BRUCE
5416 W. 24th Pl., Cicero, Ill.
(Reed-Prentice Co.)

QUALLY, LLOYD E.
Temperature Equipment Corp.
716 N. Kostner, Chicago, Ill.

QUEISSER, ARTHUR J.
110 E. 9th St., Indianapolis, Ind.
(Queisser Bros.)

RACKOW, JOHN L.
Eclipse Manufacturing Co.
P. O. Box 338, Lake Zurich, Ill.

RADEMACHER, GEORGE A.
Georges Manufacturing Co.
9330 W. Franklin Ave., Franklin Park, Ill.

RAYMOND, ROY D.
The Lakone Co.
500 Rathbone Ave., Aurora, Ill.

REAGAN, DON B.
Great Lakes Manufacturing Corp.
11 Industrial Rd., Hammond, Ind.

REINECKE, JEAN OTIS
Reinecke & Associates
720 N. Michigan Ave., Chicago, Ill.

REISING, VAL O.
Koppers Company, Inc.
Peoples Gas Bldg., 122 S. Michigan Ave.
Chicago, Ill.

RHODES, PAUL H.
Kent Plastics Corp.
1528 N. Fulton Ave., Evansville, Ind.

RICHARDS, T. E.
Midwest Molding & Manufacturing Co.
4630 W. Fullerton Ave., Chicago, Ill.

RICHTER, WINSTON H.
Monsanto Chemical Co.
Merchandise Mart, Chicago, Ill.

ROACH, RICHARD J., JR.
653 E. Chicago Ave., Palatine, Ill.
(Durez Plastics & Chemicals, Inc.)

ROBBINS, KENNETH O.
Robbins Tool & Die Co.
519 Maple Row, Elkhart, Ind.

ROESSLER, H. L.
A. E. Rubber Stamp Service, Inc.
605 W. Washington Blvd., Chicago, Ill.

ROGAN, EDWARD
Rogan Bros.
8025-33 N. Monticello Ave.
Skokie, Ill.

ROGAN, JULIAN J.
Rogan Bros.
8025-33 N. Monticello Ave.
Skokie, Ill.

ROSLEY, HOWARD A.
2107 Oak St., Northbrook, Ill.
(E. I. duFont deNemours & Co., Inc.)

ROUZER, KENNETH A.
18452 Roy St., Lansing, Ill.
(General American Transportation Corp.)

ROWE, LEIF A.
William Thoresen Co.
2035 Wabansia Ave., Chicago, Ill.

ROXBURGH, GEORGE
Celanese Corporation of America
1514 Merchandise Mart, Chicago, Ill.

RUEKBERG, H. S.
Elmer E. Mills Corp.
2930 N. Ashland Ave., Chicago, Ill.

RUGGLES, FRANCIS M.
The M. W. Kellogg Co.
79 E. Adams St., Chicago, Ill.

RUNDGREN, NELS E.
Metalmaster, Inc.
5292 Northwest Highway, Chicago, Ill.

RUSCHMAN, GORDON A.
The Richardson Co.
27th Ave., & Lake St., Melrose Park, Ill.

SAFIANOFF, ALBERT
4049 W. 58th Pl., Chicago, Ill.
(Victory Manufacturing Co.)

SANDERS, PHILIP H.
Sobenite, Inc.
1026 W. King St., South Bend, Ind.

SANGERMAN, M. R.
Nu-Dell Plastics Corp.
2250 N. Pulaski Rd., Chicago, Ill.

SCHEER, HARRY
320 S. Plymouth Ct. 4, Chicago, Ill.
(Superior Plastics Div-Commonwealth Plastics, Inc.)

SCHIFF, CHARLES
Breyer Molding Co.
2536 W. Lake St., Chicago, Ill.

SCHMIDT, JOSEPH J.
9627 S. Oglesby Ave., Chicago, Ill.
(Lester-Phoenix, Inc.)

SCHMIDT, WILLIAM
Autopoint Co.
1801 Foster Ave., Chicago, Ill.

SCHMITZ, CARL EDWARD
Crane Packing Co.
1800 Cuyler Ave., Chicago, Ill.

SCHRAMM, ROY L.
5840 W. Foster Ave., Chicago, Ill.
(Sandee Manufacturing Co.)

SCHRECK, RICHARD WESLEY
Watson Stillman Co.
228 N. LaSalle St., Chicago, Ill.

SCHROETER, E. K.
Presco Plastics
P. O. Box 875, Milwaukee, Wis.

SCHULTZ, ARTHUR J.
35 S. Cook St., Denver, Colo.

SCHULZ, RICHARD O.
Richard O. Schulz Co.
2425 N. 75th Ave., Elmwood Park, Ill.

SCHWARTZ, HAROLD D.
American Plastic Manufacturing Co., Inc.
2938 N. Halsted St., Chicago, Ill.

SEKOWSKI, JOHN L.
7019 W. Cornelia Ave., Chicago, Ill.
(Midland Die & Engraving Co.)

SELF, M. A.
515-138th St., Hammond, Ind.
(Bee Chemical Co.)

SHANLY, JOHN S.
181 Mary St., Binghamton, N. Y.
(J. Boos)

SINGER, EDWARD
Victory Manufacturing Co.
1722 W. Arcade Pl., Chicago 12, Ill.

SKELTON, OWEN E.
Modern Plastic Corp.
North Shore Dr., Benton Harbor, Mich.

SLINGLUFF, EUGENE
Sunlite Manufacturing Co.
317 S. 1st St., Milwaukee, Wis.

SLOTTAG, HARRY F.
G. Felsenthal & Sons
4100 W. Grand Ave., Chicago, Ill.

SMITH, RALPH W.
RCA Victor Division
666 Lake Shore Dr., Chicago, Ill.

SMITH, RICHARD P.
A.G.P. Corporation
P. O. Box 318, Peru, Ind.

SORRELL, RICHARD HAMILTON
719 Belle Forte, Oak Park, Ill.
(Superior Plastics Corp.)

SPIVAK, SIDNEY G.
Chicago Molded Products Corp.
1020 N. Kolmar Ave., Chicago, Ill.

SPODNYAK, PAUL
Uptown Tool Works, Inc.
4632 Fullerton Ave., Chicago, Ill.

STEIN, ALEXANDER W.
American Rotary Tools Co., Inc.
5909 N. Sheridan Rd., Chicago, Ill.

STEPHENS, ROBERT S.
Coffield-Stephens Associates
7720 N. Sheridan Rd., Chicago, Ill.

STOEFFHAAS, WALTER H.
Colonial Kolonite Co.
2212 W. Armitage Ave., Chicago, Ill.

CHICAGO (cont'd.)

STONE, SAM J.
Breyer Molding Co.
2536 W. Lake St., Chicago, Ill.

STOWE, CLARENCE H.
Stowes Plastic Products
3118 W. Atkinson Ave., Milwaukee, Wis.

SWIFT, L. J.
Box 314, Route 1, Barrington, Ill.
(Jarrow Products)

SZANTAY, ELMER D.
Sandee Manufacturing Co.
5050 Foster Ave., Chicago, Ill.

SZANTAY, VIOLET
Santay Corp.
351 N. Crawford Ave., Chicago, Ill.

TERRILL, DAVID W.
127 N. Ashland Ave., Palatine, Ill.
(C. E. Niehoff & Co.)

THOMSEN, JACK WARREN
823 S. Kensington Ave., LaGrange, Ill.
(The Richardson Co.)

TICKNER, LAWRENCE H.
Autopoint Co.
1801 W. Foster Ave., Chicago, Ill.

TIETZ, PAUL C.
Tietz & Baur Plastics, Inc.
Lake & Roy St., Melrose Park, Ill.

TULLEY, FRED
Amos Molded Plastics
Rm. 320, 1005 W. Belmont Ave.,
Chicago, Ill.

TYSON, ROBERT M.
Monsanto Chemical Co.
1104 Merchandise Mart, Chicago, Ill.

VELLINGA, JOHN
Elgin Molded Plastics Co.
909 Grace St., Elgin, Ill.

VON HOLDT, JOHN W.
Plas Tool Co.
7072 N. Glenwood Ave., Chicago 26, Ill.

VOSS, A. H.
5859 N. Oxford Dr., Indianapolis, Ind.
(Western Electric Co.)

WAHL, WARREN P.
Wahl Clipper Corp.
407 E. 3rd St., Sterling, Ill.

WALKER, GEORGE THOMAS, JR.
513 61st St., Kenosha, Wis.
(Midwest Molding & Manufacturing Co.)

WEICHMANN, ED
Cambridge Molded Plastics
732 N. Michigan Ave., Chicago, Ill.

WEIRICH, WALLACE J.
5032 N. Neva Ave., Chicago, Ill.
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BAUMGARTIL, GEORGE K.
149 Belleville Ave., Belleville, N. J.
(Ideal Plastics Co.)

BECK, GEORGE
Columbia Engineering Co., Inc.
113-119 Sussex Ave., Newark, N. J.

BECK, GEORGE H.
Columbia Engineering Co., Inc.
113-119 Sussex Ave., Newark, N. J.

BECK, JOHN
369 Martin Rd., Union, N. J.
(Dillon-Beck Manufacturing Co.)

BEEL, PAUL
19 Martindale Rd., Short Hills, N. J.
(Beel Engineering Co.)

BEEL, RICHARD PAUL
Beel Engineering Co.
411 Mulberry St., Newark, N. J.

BELL, RICHARD M.
International Business Machines
Plant #2, Poughkeepsie, N. Y.

BERGQUIST, VICTOR P.
529 Homer Terrace, Union, N. J.
(Newark Die Co.)

BERTHOLD, JOHN W.
New Freedom, Pa.
(American Insulator Corp.)

BESSERMAN, JULES R.
Colorite Plastics of N. J., Inc.
35 Iowa Ave., Patterson, N. J.

BIKLEN, DONALD W.
Orangeburg Manufacturing Co., Inc.
Orangeburg, N. Y.

BIRNEY, EDWARD W.
Consolidated Molded Products Corp.
309 Cherry St., Scranton, Pa.

BISHOP, THOMAS G.
The Hydraulic Press Manufacturing Co.
Box 91, Teaneck, N. J.

BLAKE, RAYMOND S.
1204 Lenox Ave., Plainfield, N. J.
(Plastic Molders Supply Co.)

BOKOR, JOHN, JR.
2 Irving St., Nixon, N. J.
(Kaye Plastics Corp.)

BONANNO, JOSEPH L.
501 Berkeley Ave., South Orange, N. J.
(The Lionel Corp.)

BORTON, CHARLES A.
Hercules Powder Co.
Parlin, N. J.

BOTTLEMAN, RAY R.
7 Longwood Ave., Fitchburg, Mass.
(Great American Plastics Co.)

BRADBURY, WILLIAM B.
Plastic Molders Supply Co.
915 W. Front St., Plainfield, N. J.

BRAGAR, NORMAN
Norman Bragar Co.
1060 Broad St., Newark, N. J.

BRANNAN, R. E.
9 Loraine Rd., Summit, N. J.
(Bakelite Co., Div. of UC&C Corp.)

BRIGHTMAN, GEORGE
315 Stevens Ave., Ridgewood, N. J.
(Bakelite Co., Div. of UC&C Corp.)

BROWER, VAN PELT, JR.
Celanese Corporation of America
P. O. Box 1000, Belvidere, N. J.

BROWN, GORDON
Bakelite Co., Div. of UC&C Corp.
30 E. 42nd St., New York, N. Y.

BUSCHMANN, WARREN T.
816 Mountain Ave., Bound Brook, N. J.
(Bakelite Co., Div. of UC&C Corp.)

CARD, FRANCIS E.
Panelyte Div., St. Regis Paper Co.
Enterprise Ave., Trenton, N. J.

CAREY, JAMES E.
Shell Chemical Corp.
1120 Commerce Ave., Union, N. J.

CARUSO, JOSEPH N.
Atlantic Tool & Die Co.
646 Grove St., Elizabeth, N. J.

CLARE, GEORGE
Claremould Plastics Co.
200 Wright St., Newark, N. J.

CLARE, PHILIP
Claremould Plastics Co.
200 Wright St., Newark, N. J.

CODDINGTON, E. ROBERT
National Rubber Machinery Co.
384 Getty Ave., Clifton, N. J.

COLVIN, HENRY F.
270 W. End Rd., S. Orange, N. J.
(Colvin-Friedman Co.)

COOK, JOHN H., JR.
Mack Molding Co.
Wayne, N. J.

CORDARO, LEO
Premier Tool & Manufacturing Co.
28 Margaretta St., Newark, N. J.

CRISTELL, ANTON T.
Ross Tool & Manufacturing Co.
140 Clifford St., Newark, N. J.

CROWIN, EDWARD W.
75 Garden Rd., Little Silver, N. J.
(Hercules Powder Co.)

CSASZAR, ERNEST J.
16 Boyden Ave., Maplewood, N. J.
(Eagle Tool & Machine Co.)

DE BREE, F. WILLIAM
Hercules Powder Co.
500 5th Ave., New York, N. Y.

DE HOFF, RONALD L.
42 Oakland Ave., Springfield, N. J.
(Shell Chemical Corp.)

DE MATTEO, ADOLPHE J.
Watson-Stillman Co.
Aldene Rd., Roselle, N. J.

DE MATTIA, MARIUS
761 Broad Ave., Leonia, N. J.

DENNISON, A. VARD
53 Benson St., Glen Ridge, N. J.
(Newark Die Co.)

DINZL, RICHARD W.
525 Prospect St., Westfield, N. J.
(Watson-Stillman Co.)

DOANE, MALCOLM E.
226 Inwood Ave., Upper Montclair, N. J.
(H. V. Hardman Co., Inc.)

DOERFLER, LOU, JR.
Artistic Engraving Co.
53 Academy St., Newark, N. J.

DOWNS, MYRON H.
49 Cleveland Rd., Caldwell, N.J.
(Irvington Varnish & Insulator Co.)

DOYLE, ROBERT
454 Delaware Ave., Belvidere, N. J.
(Celanese Corporation of America)

DUBENITZ, MICHAEL G.
22 Kate Lane, Metuchen, N. J.
(Durez Plastics & Chemicals, Inc.)

DUBMAN, JACK
J. G. Tilp, Inc.
Springfield & Middletown Rds.
Union, N. J.

DU BOIS, J. HARRY
Mycalex Corporation of America
60 Clifton Blvd., Clifton, N. J.

DURST, ROBERT F.
82 Cleveland St., Orange, N. J.
(Federal Telecommunication Labs., Inc.)

EBER, LEONARD K.
General Electric Co.
570 Lexington Ave., New York, N. Y.

EGG, LEON R.
Garfield Manufacturing Co.
P. O. Box 59, Garfield, N. J.

ELLIS, ROBERT C.
Dillon-Beck Manufacturing Co.
1227 Central Ave., Hillside, N. J.

ENGLER, HAROLD F.
B. F. Goodrich Chemical Co.
475 5th Ave., Rm 1600, New York, N. Y.

ERNST, ARTHUR H.
83 Church St., Woodbridge, N. J.
(Lapin Products, Inc.)

FAMELY, MAX
53 Berlant Ave., Linden, N. J.
(Garwood Plastics, Inc.)

FAYCIK, FRANK H.
RFD #5, Box 425, New Brunswick, N. J.
(Plastylite Corp.)

FEELEY, M. JOSEPH
104 Linden St., Wyckoff, N. J.
(Boonton Molding Co.)

FERRIER, JAMES N.
134 Franklin Ave., Ocean Grove, N. J.
(Dillon-Beck Manufacturing Co.)

FLYNN, JAMES W.
Celanese Corporation of America
180 Madison Ave., New York, N. Y.

FONTENELLI, JOHN J.
Fibro Corp.
501 South Ave., Garwood, N. J.

FONTENELLI, FRANK J.
Fibro Corp.
501 South Ave., Garwood, N. J.

FORIS, JULIUS Z.
Columbia Engineering Co., Inc.
113-119 Sussex Ave., Newark, N. J.

FORTNEY, EUGENE LOYD
Fortney Manufacturing Co.
247 N.J. RR Ave., Newark, N. J.

FOX, ROBERT J.
Detroit Mold Engineering Co.
1217 Central Ave., Hillside, N. J.

FRACKENPOHL, ROLAND
100 Hillside Terrace, Irvington, N. J.
(Interstate Mold Hobbing Co.)

FROSCH, CARL J.
Bell Telephone Labs., Inc.
Murray Hill, N. J.

FRUTCHEY, HAROLD E.
304 Moore St., Hackettstown, N. J.
(Bergen Toy & Novelty Co.)

FUCHS, JOHN, JR.
262 Salem Rd., Union, N. J.
(L. Doerfler Manufacturing Co., Inc.)

GARRISON, DAVID H., JR.
1 Mali Dr., N. Plainfield, N. J.
(The Garrison Co.)

GEDROWICZ, FRANK
995 Sanford Ave., Irvington, N. J.
(Thomas Manufacturing Corp.)

GERING, HERMAN
Gering Products, Inc.
7th St. & Monroe Ave., Kenilworth, N. J.

GERING, LARRY
Gering Products, Inc.
7th St. & Monroe Ave., Kenilworth, N. J.

GERLACH, ROBERT M.
3 Marshall St., 8F, Irvington, N. J.
(Newark Die Co.)

GEROW, M. R.
74 S. Mountain Ave., Montclair, N. J.
(Consulting Engineer)

GERSHEN, IRVIN J., MAJOR
(No Address)

GESELL, JOHN H.
Federal Telecommunication Labs., Inc.
500 Washington Ave., Nutley, N. J.

GIAIMO, MARIO
2184 Alpine Ave., Union, N. J.
(Lionel Corp.)

GIANNOTTA, CARMEN R.
The M. W. Kellogg Co.
P. O. Box 469, Jersey City, N. J.

GIESE, WILLIAM
Berkeley Eng. & Mfg. Co.
Berkeley Heights, N. J.

GILMAN, LUCIUS
P. O. Box 65, Lake Hopatcong, N. J.
(Ordnance Dept., Picatinny Arsenal)

GLANDER, CLARE
73 Winsor Pl., Glen Ridge, N. J.
(Cowan-Boyden Corp.)

GLIDER, SYDNEY S.
1617 St. Marks Ave., Brooklyn, N. Y.
(Mastro Plastics Corp.)

GODFREY, GEORGE J.
15 Bryan Court, Rutherford, N. J.
(Koppers Co., Inc.)

GOLDRICK, RICHARD M.
Irvington Varnish & Insulator Co.
6 Argyle Terrace, Irvington, N. J.

GORMLEY, WILLIAM L.
American Hard Rubber Co.
Park Pl., Butler, N. J.

GOULD, WILLIAM
93 Sagamore Rd., Millburn, N. J.
(Keystone Plastics Co., Inc.)

GROFF, FRAZIER
Bakelite Co., Div. of UC&C Corp.
Bound Brook, N. J.

GROISS, HENRY
125 Ridgeley Ave., Iselin, N. J.
(Middlesex Tool & Machine Works)

GROWLEY, JAMES T.
Celanese Corporation of America
180 Madison Ave., New York, N. Y.

GRYCE, W. W.
272 Hutton St., Jersey City, N. J.
(Louis Marx Co.)

HAGGERTY, JAMES
H. Muehlstein & Co., Inc.
60 E. 42nd St., New York, N. Y.

HALL, G. LESTER
R. A. Koegl Stamp & Die Works
9 Evans Terminal, Hillside, N. J.

HALLIDAY, KENNETH C., JR.
Eclipse-Pioneer Div.
Bendix Aviation Corp.
Teterboro, N. J.

HAMMOND, ROGER H.
Mack Molding Co.
Ryerson Ave., Wayne, N. J.

HANSON, ERNEST R.
53 Church St. E., Bloomfield, N. J.
(Consultant)

NEWARK (cont'd.)

HARTONG, HAROLD
Koppers Co., Inc.
Snyder Ave., Berkeley Heights, N. J.

HAYES, RALPH F.
Gering Products, Inc.
7th St. & Monroe Ave., Kenilworth, N. J.

HERRING, JOHN A.
Naugatuck Chemical Co.
254 4th Ave., New York, N. Y.

HOEHN, ROBERT H.
Mack Molding Co.
Ryerson Ave., Wayne, N. J.

HOLRAN, PAUL D.
Gering Products, Inc.
7th St. & Monroe Ave., Kenilworth, N. J.

HOLZL, ALBERT B.
Eagle Tool & Machine Co.
5 Evans Terminal Rd., Hillside, N. J.

HONISH, JOHN K.
25 Underelift Rd., Millburn, N. J.
(Bakelite Co., Div. of UC&C Corp.)

HRONEK, JOHN F.
Fellows Gear Shaper Co.
2206 Empire State Bldg., New York, N. Y.

HUTCHINGES, JOSEPH L.
Brosites Machine Co., Inc.
50 Church St., New York 7, N. Y.

HYDE, WALTER C.
Spaulding Fibre Co., Inc.
965 Broad St., Newark, N. J.

HYMAN, JOSEPH B.
Catalin Corporation of America
Fords, N. J.

INGHAM, PHILIP H.
Interchemical Corp.
Bound Brook, N. J.

JORDAN, CLIFFORD
Plastex Process Co.
230 W. Passaic St., Maywood, N. J.

JORDAN, RUSSELL C.
Plastex Process Co.
230 W. Passaic St., Maywood, N. J.

JOYCE, EDWARD F., 3rd
Thermacote Co.
301 Mt. Pleasant Ave., Newark, N. J.

JUDGE, PHILLIP S.
Stoney-Mueller, Inc.
Lyndhurst, N. J.

JUNG, ALEX
252 Tichenor Ave., S. Orange, N. J.
(Bakelite Co., Div. of UC&C Corp.)

JUPA, JULIUS A.
664 Salem Ave., Elizabeth, N. J.
(The M. W. Kellogg Co.)

KAISER, EDWIN T.
U. S. Fiber & Plastics Corp.
23 Union St., Stirling, N. J.

KAMINSKI, WALTER
2275 Vaux Hall Rd., Union, N. J.
(Elizabeth Tool & Die Co., Inc.)

KAST, HAROLD L.
Plastic Inlays, Inc.
Broad St., Summit, N. J.

KATELUS, GEORGE J.
13 Wade Ave., Cranford, N. J.
(Irvington Varnish & Insulator Co.)

KAUFMAN, ALBERT A.
Industrial Synthetics Corp.
225 North Ave., Garwood, N. J.

KAUFMAN, KENNETH A.
1822 Grandview Ave., Westfield, N. J.
(Gering Products, Inc.)

KAYE, S. LEON
158 Maple Ave., Metuchen, N. J.
(Kaye Plastics Corp.)

KEMPS, ANTON THEODORE
New Jersey Tool & Die Co.
800 Colfax Ave., Kenilworth, N. J.

KENEN, IRVIN O.
Nixon Nitration Works
Nixon, N. J.

KEREKES, THEODORE J.
44 Broad St., Newark, N. J.
(Columbia Engineering Co.)

KEUSCH, E. F.
Tech-Art Plastics Co.
Ridgedale Ave., Morristown, N. J.

KLEIN, PHILIP
Gilbert Plastics, Inc.
1415 Chestnut Ave., Hillside, N. J.

KNOWLES, ROGER B.
Manhattan View Towers, Apt. 6H
6515 Blvd. E., W. New York, N. J.

KOEGL, RICHARD A.
R. A. Koegl Stamp & Die Works
9 Evans Terminal, Hillside, N. J.

KOOP, NEIL A.
Gering Products, Inc.
7th & Monroe Ave., Kenilworth, N. J.

KUETTEL, G. M.
E. I. duPont deNemours & Co., Inc.
Polychemicals Dept.,
350 Fifth Ave., New York, N. Y.

LA GRUTTA, PASCAL A.
78 E. Bradford Ave., Cedar Grove, N. J.
(Garray Plastics Co.)

LANGE, ARTHUR
357 Plymouth Rd., Union, N. J.
(Park Plastics Co.)

LECKY, HERBERT S.
E. I. duPont deNemours & Co., Inc.
Arlington Works, Arlington, N. J.

LEGHORN, KENNETH M.
Sun Tube Corp.
181 Long Ave., Hillside, N. J.

LEITER, RICHARD M.
Celanese Corporation of America
180 Madison Ave., New York, N. Y.

LESTER, WILLIAM M.
Pyro Plastics Corp.
690 Chestnut St., Union, N. J.

LICHTENSTEIN, DAN
450 Bath Ave., Long Branch, N. J.
(Signal Corps Engr. Lab.)

LINDAU, J. W., 3rd
Southern Plastics Co., Inc.
408 Pendleton St., Columbia, S. C.

LODGE, WALTER S.
332 Jordan Rd., New Milford, N. J.
(B. F. Goodrich Chemical Co.)

LOMBARDI, JOHN P.
2685 Meister Ave., Union, N. J.
(Emhart Mfg. Co., Stonington Div.)

LOWE, RICHARD R.
5 Salem Park, Elizabeth, N. J.
(Dillon-Beck Manufacturing Co.)

LYNCH, H. A. WILFRED
Boonton Molding Corp.
Boonton, N. J.

LYNN, EDWIN W.
166 Madison Ave., Irvington, N. J.
(Celluplastic Corp.)

MACKSEY, KENNETH
100 Main St., Wayne, N. J.
(Mack Molding Co.)

MALASHEVITZ, ALEX J.
Catalin Corporation of America
Fords, N. J.

MANN, BASIL E.
19 Parkview Ave., Belleville, N. J.
(Dillon-Beck Manufacturing Co.)

MARCY, ROBERT J.
302 W. 12th St., New York, N. Y.

MAXWELL, BRYCE
Princeton University, Plastics Lab.
30 Charlton St., Princeton, N. J.

MAYER, MARK G.
165 Isabella Ave., Newark, N. J.
(Thomas Manufacturing Corp.)

MC CABE, THOMAS L., JR.
(No Address)

MC CARTHY, VINCENT D.
Gering Products, Inc.
7th St. & Monroe Ave., Kenilworth, N. J.

MC GUIRE, THOMAS M.
Bakelite Co., Div. of UC&C Corp.
30 E. 42nd St., New York, N. Y.

MEARS, VINCENT L.
(No Address)

MEYER, JOSEPH E.
1020 Evergreen Ave., Plainfield, N. J.
(Prolon Plastics)

MIKSCH, NATHAN
Newark Die Co.
24 Scott St., Newark, N. J.

MORGAN, COLEMAN P.
Vulcanized Rubber & Plastics Co.
5 S. Pennsylvania Ave.
Morrisville, Pa.

MOSS, HIBBERT W.
62 Beekman Rd., Summit, N. J.
(Improved Machinery Co.)

MUNYAK, JOHN A.
32 Oakview Ave., Maplewood, N. J.
(Gering Products, Inc.)

NATURALE, ANTHONY
50 Hillyer St., Orange, N. J.
(Maryland Plastics)

NATURALE, JOSEPH W.
100 Ellington St., E. Orange, N. J.
(Naturale Tools, Inc.)

NEWCOMB, BENJAMIN R.
John Waldron Corp.
P. O. Box #791, New Brunswick, N. J.

NEWMAN, HARRY
Riverdale Plastics Develop. Corp.
423 Third St., Jersey City, N. J.

NICHOLL, J. F.
252 Christopher St., Upper Montclair, N. J.
(Lumite Div., Chicopee Mfg. Corp. of [illegible])

NICHOLS, ANTHONY
Celluplastics Corp.
50 Avenue L, Newark, N. J.

NICLAUS, WILLIAM L.
Wilnet Engineering & Manufacturing Co.
244 Dukes St., Kearny, N. J.

NILO, SADVATORE C.
(No Address)

NUFER, ARTHUR
11 Colonial Way, Rahway, N. J.
(Bakelite Co., Div. of UC&C Corp.)

O'CONNELL, JOHN JOSEPH, 3rd
Shell Development Co.
10 Commerce Court, Newark, N. J.

OGANDO, JOSEPH A., JR.
177 Wheaton Pl., Rutherford, N. J.
(Plastic Mold Tool & Die Co.)

O'HAGAN, WILLIAM D.
111 Willow Brook Rd., Staten Island, N. Y.
(Boonton Molding Co.)

OLSEN, M. A.
1 Paulus Blvd., New Brunswick, N. J.
(Modern Plastics)

PALME, ANTON J.
444 Prospect St., S. Orange, N. J.
(Fidelity Tool Co.)

PALMER, SPENCER E.
Eastman Chemical Products, Inc.
Kingsport, Tenn.

PASECZNYK, JOSEPH M.
Malapardis Rd., Whippany, N. J.
(Plastic Inlays, Inc.)

PATON, JOHN B.
91 Beech St., Arlington, N. J.
(E. I. duPont deNemours & Co., Inc.)

PEACOCK, WILLIAM HENRY
43 Grove St., Elizabeth, N. J.
(Calco Chemical Div., Amer. Cyanamid)

PEBLY, HARRY E., JR.
153 E. Blackwell St., Dover, N. J.
(Ordnance Dept., Picatinny Arsenal)

PECKTAL, JACK R.
Stephenville Ranch, Homestead, Rd.
Metuchen, N. J.
(Eastman Chemical Products, Inc.)

PERO, ALDO S.
8 Circle Rd., Florham Park, N. J.
(APSCO Co.)

PETERS, MARK W.
Nixon Nitration Works
Nixon, N. J.

PFAFF, PETER
Wilmot Engineering & Manufacturing Co.
244 Dukes St., Kearny, N. J.

PFAFF, WILLIAM G.
529 A. Pershing Rd., Clifton, N. J.
(Newark Die Co.)

PLUME, D. S.
41 Oakley Ave., Summit, N. J.
(Rohm & Haas Co.)

PORTER, CHARLES A.
P. O. Box 37, Mauricetown, N. J.
(Kimble Glass Co.)

PRASSL, ANTON
1915 Oakwood Parkway, Union, N. J.
(L. Doerfler Manufacturing Co., Inc.)

PRESTON, E. KIRBY
143 Bryant Ave., Springfield, N. J.
(Celluplastics, Inc.)

PRESTON, WILLARD M.
99 Baltusrol Way, Short Hills, N. J.
(Koppers Co., Inc.)

PREUSS, PETER P.
1852 Lamberts Mill Rd., Westfield, N. J.
(Gilbert Plastics Co.)

PROBST, KARL J.
Reilly Tar & Chemical Corp.
191 Doremus Ave., Newark, N. J.

PYHEL, HENRY J.
2017 Hudson Terrace, Fort Lee, N. J.
(Hendick Co.)

QUASNOSKY, BERT C.
219 Glenbrook Rd., Stamford, Conn.
(Schick, Inc.)

QUITONI, LOUIS J.
Rodway Products, Inc.
RFD #3, Box 129, Clark Twp., N. J.

RAHM, LOUIS F.
Princeton University, Plastics Lab.
20 Charlton St., Princeton, N. J.

RAHM, WALTER E.
10 Yale Terrace, Montclair, N. J.
(Boonton Molding Co.)

REED, GEORGE H.
American Hard Rubber Co.
93 Worth St., New York, N. Y.

REESE, EDWIN P.
609 Northumberland Rd.
W. Englewood, N. J.
(Consolidated Molded Products)

REXER, ALFRED T.
647 Hort St., Westfield, N. J.
(Industrial Plastics Co.)

RHEIN, JOSEPH P.
205 Central Ave., Cranford, N. J.
(Rohm & Haas Co.)

RIEDER, GEORGE H.
R. A. Koegl Stamp & Die Works
9 Evans Terminal, Hillside, N. J.

RINALDI, JAMES D.
Newark Die Co.
24 Scott St., Newark, N. J.

ROGERS, JOSEPH C.
21 Raleigh Rd., Washington Park
Nixon, N. J.
(Industrial Hard Chromium Co.)

ROGERS, THOMAS F.
102 Holden St., Bennington, Vt.
(Hendick Co.)

ROSENHEIM, DAVID J.
28 Parker Ave., Deal, N. J.
(Laurel Plastics, Inc.)

ROWAN, EDWARD W.
O'Hara & Rowan Associates
Bassett Bldg., Summit, N. J.

SANDERS, CHARLES B.
Dillon-Beck Manufacturing Co.
1227 Central Ave., Hillside, N. J.

SANDERS, MILTON A.
734 Vince St., Elizabeth, N. J.
(Bloomfield Molding Co.)

SANDLER, JACK
Hungerford Plastics Corp.
114 Beach St., Rockaway, N. J.

SCHAAF, PAUL H., JR.
33 Cleremont Ave., Irvington, N. J.
(Pyro Plastic Corp.)

SCHAUL, J. S., JR.
211 N. 15th St., Bloomfield, N. J.
(Resistoflex Corp.)

SCHEIDT, THEODORE WILLIAM
412 Sanhican Dr., Trenton, N. J.
(Consolidated Cork Corp.)

SCHENKMAN, JACK
2799 Carol Rd., Union, N. J.
(Industrial Plastic Co.)

SCHIEFER, CARL EUGENE
International Business Machines
Plant #2, Poughkeepsie, N. Y.

SCHMIDT, PAUL E.
Panelyte Div., St. Regis Paper Co.
Enterprise Ave., Trenton, N. J.

SCHNUR, MARTIN
Martin Schnur Associates
15 W. Park St., Newark 2, N. J.

SCHRAG, WAYNE M.
643 Hanford Pl., Westfield, N. J.
(Gering Products, Inc.)

SCHULE, ELMER C.
Allied Chemical & Dye Corp.
Columbia Rd., Morristown, N. J.

SCHUSTER, GEORGE J.
Newark Die Co.
24 Scott St., Newark, N. J.

SCRIBNER, GEORGE K.
Boonton Molding Co.
326 Myrtle Ave., Boonton, N. J.

SHANLY, JOHN S.
73 Beechwood Rd., Summit, N. J.
(J. Boos)

SHAW, STANFORD H.
Shaw Insulator Co.
160 Coit St., Irvington, N. J.

SHERMAN, JAY D.
25 Shadylawn Dr., Madison, N. J.
(Reed-Prentice Corp.)

SIMMONS, PETER W.
12 Birchwood Lane, Hillsdale, N. J.
(The Dow Chemical Co.)

SIMON, JACOB
Gilbert Plastics, Inc.
1415 Chestnut Ave., Hillside, N. J.

SKEELS, ARTHUR N.
Art Roll Leaf Stamping Co.
4201 Hudson Blvd., N. Bergen, N. J.

SMITH, HERBERT A. T.
Thermold Co.
Manlius, N. Y.

SMITH, WALTER F.
American Hard Rubber Co.
Park Pl., Butler, N. J.

SMYTHE, C. WYATT
214 Inwood Ave., Upper Montclair, N. J.
(American Cyanamid Co.)

SOULES, EDWARD B.
Detroit Mold Engineering Co.
1217 Central Ave., Hillside, N. J.

SPAAK, ALBERT
199 First Ave., Little Falls, N. J.
(DeMattia Machine & Tool Co.)

SPITZIG, EDMUND W.
Newark Die Co.
24 Scott St., Newark, N. J.

STAAB, GEORGE J.
29 Addison Dr., Short Hills, N. J.
(Sterling Plastics Co.)

STANLEY, FRED B.
Modern Plastics
575 Madison Ave., New York, N. Y.

STEINER, JAY
694 Haxtun Ave., Orange, N. J.
(F. J. Stokes Machine Co.)

STERN, JEROME J.
265 W. Hudson Ave., Englewood, N. J.
(Whyte Manufacturing Co.)

STEWART, JAMES M.
Federal Electric Products Co.
50 Paris St., Newark, N. J.

STURKEN, ROBERT C.
Frank W. Egan & Co.
115 Lincoln Blvd., Bound Brook, N. J.

SWARTZ, C. KENNETH
Consolidated Molded Products Corp.
309 Cherry St., Scranton, Pa.

TAYLOR T. SMITH
45 Grover Lane, Caldwell, N. J.
(United States Testing Co.)

TEDESCHI, THOMAS
19 Speedway Ave., Newark, N. J.
(Gilbert Plastics, Inc.)

THOMAS, ISLYN
286 Kings Rd., Madison, N. J.
(Newark Die Co.)

THOMSON, JAMES A.
Thomson Tool & Mold Co.
28 Howard St., N. Plainfield, N. J.

THORWESTER, GEORGE A.
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352 Plymouth Rd., Union, N. J.

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67 Friendly Rd., Cranston, R. I.
(Cornell Dubilier Elec. Corp.)

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57 Miller St., Warren, R. I.

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112 Point St., Providence, R. I.

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336 Weir St., Taunton, Mass.

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3922 Post Rd., Worwick, R. I.
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THE *Injection* MOLDERSCOPE

By A. R. Morse
President, Injection Molder's Supply Co.

"It is the freedom to disagree, to quarrel with authority, in intellectual matters to think otherwise, that has made this nation what it is today." Dr. James B. Conant

SEASON'S END—1953

Summer 1953 sees some marked easing of injection machine deliveries. There is still some price shuffling and jockeying of deliveries going on as the realities of machinery production and competition are faced. One leading make of injection machine, according to revised quotation just submitted to prospects, shows a welcome downward adjustment of about 10% from a preceding all-time high.

HOME MADE MACHINES (Again)

Month before last, I was severely castigated for suggesting that a molder could build a machine for less than he could buy one! I had my facts before I wrote this. I was called blackguard, traitor, turncoat and other worse names by an equipment manufacturer. But the same mail also brought additional proof that it **was** possible to build a machine for much less than it cost to buy one!

There are many skilled maintenance crews in injection plants today that were not found five years ago. If you saw the way—the professional way—the boys at Kusan rebuilt their fire-damaged Reeds, or the way Ludwig Leaf's boys at Caldwell Products take an old clunker and refit it into a modern production tool, you would see how any observant person could be led to the conclusion posed month before last.

It is perfectly possible to build certain types of machinery like an injection machine or grinder for less than one can buy it. But often in these cases, one's own time is entered for nothing or at cost. However, if you are going to build **and** sell injection machines, your price would end up being just about what everyone else's already in the business would be, or you would soon be out of business. You don't assume all the expenses of a manufacturer when you build **one** special purpose machine, which your maintenance facilities are adequate to handle. And undoubtedly, you could slip a lot of your expenses like coils, valves, tubing, timers, limit switches, yes, even a pump and motor in under an expense heading, further lowering your capitalized investment in a home-made machine.

We need more fellows who are not afraid to breast the entrenched powers that be, for many of the fine, tough new thermoplastics are now ahead of the machines available to mold them! Progress only comes with a little prodding, especially in the field of injection machines, where tooling changes are costly, and managements are rightly reluctant to rush into every new thing that comes along.

Don't forget that if the past is any criterion, most of the new ideas for handling the new thermoplastics will come from the molder.

ANOTHER LOOK AT THE HEATER

We are re-working for the umpteenth time a heater on which we have tried about every design of spreader you can think of. The back end of the heater is the crux of most of our molding problems today. The front end—well you can increase or decrease your storage area for hot material without making too much difference one way or another. I won't go into that now. Where the real problem lies is in the transition of the cold chunk of material ahead of the plunger from a rock hard "cake" into molten plastic capable of flowing through a heater under pressure.

The Lewis and the Crown and Van Dorn use multiple feeding strokes of a generally smaller diameter plunger with some success. The stuffing feature on larger machines also acts to rupture this "cake" that tends to slow up plunger advance just at the critical moment of injection when the hot material is bursting into the cavity. I therefore predict that most of our future development will have to be concerned with design and re-design of the back end of the spreader, and the cold end of the heater if we are to handle the newer materials at high molding speeds. More heat on the back end, less on the front; more changes in the back end, fewer on the front end therefore seems to be a safe view of heater developments over the next two years.

HIGH IMPACT STYRENE

A few wisps of smoke still rise now and then from our remarks about the fact that the wonderful new styrenes should be studied individually and experience gained with each of the new variations before jobs are quoted using them. One by one, the people who flared up when I said that one new styrene copolymer molded differently from another, and that derating was likely to be more severe in some cases than in others, have admitted that our comments were right, and that the molder will do well to familiarize himself with each new variant and how it molds before he sticks his neck out on it. Several observant molders have confirmed this and are already profiting by it in optimum cycles and quality molded parts that really stand up. Others are still treating all the new materials like "styrene" and are fighting the idea that there is any more than one plastic that goes into an injection machine! You spot these die hards through increased maintenance costs, sticking, burning and mold troubles. Unfortunately, when you go into a store displaying molded products, you can also spot it there if you are observant enough — and there's where it can hurt all of us most. I stand by my earlier observations!

AROUND THE WORLD

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FRANCE

INDUSTRIE DES PLASTIQUES MODERNES

Vol. 4, No. 5, April 1953

Abstracter: Hans Mayer

THE FRENCH INDUSTRY GETS EQUIPPED

Having described the production of polystyrene molding compounds in France in their last number, this issue has been dedicated to a description of the factory and products of Kleber-Colombes in Meaux-Trilport. These factories are converters and fabricators of vinylites on an almost universal basis.

FLUORETHYLENE PRODUCTS

Concluding the series of articles on this subject a large number of applications and the techniques used in the manufacturing of these products is described. The material for this story comes from U.S. sources entirely.

SILICONES IN IRONING BOARD COVERS

A product of "Magla Products" is described. The ironing board cover is a silicone treated tissue which will absorb temperatures twice or three times higher than the untreated tissue and will not absorb moisture.

PROTECTIVE SLEEVES FOR CONNECTORS

Nylon sleeves for electrical connectors as manufactured by the Thomas and Betts Co., Elizabeth, N. J. are discussed.

FLEXIBLE POLYETHYLENE TUBES by D. Adam

The advantages of polyethylene for dispensing devices of all types, particularly tubes of the collapsible type, are described and comparisons are made with the older type containers regarding weight, flexibility, transparency, etc.

VACUUM METALISATION

A reprint of the article by M. J. Gordon Seiter of F. J. Stokes Machine Co. in the October, 1952 issue of the SPE Journal.

POLYSTYRENE LATEX IN THE PAINT INDUSTRY by L. Berthelot

Distrene S-800, manufactured by the British Resin Products, Ltd. is an emulsion of plasticized polystyrene and dibutyl and dioctylphtalate. As part of the paint it leaves a thin film which adheres easily to porous surfaces. The adherence to metallic or glass surfaces is poor. The productions of paints using this medium and their applications are discussed.

ELECTRONIC SEWING MACHINES by J. Blond

The general principles of high frequency bonding of thermoplastic materials and the construction of high frequency generators are discussed, various types, makes, and oscillating equipment used are compared and the handling and setup of these installations are explained in great detail.

THEORETICAL AND PRACTICAL ASPECTS OF THE STABILIZATION OF VINYL RESINS by G. P. Mack

This is the end of the reprint of an article by G. P. Mack, Director of Research of the Advance Chemical and Solvents Corp.

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GERMANY

KUNSTSTOFFE

March 1953

Abstracter: Anne Schwend

THEORY AND PRACTICE OF THE STABILIZATION OF VINYL COMPOUNDS, Gerry P. Mack

A detailed introduction into the theory of instability of vinyl compounds, their decomposition caused by various factors and further intensification through the presence of oxygen, heat and light is followed by a report about the different groups of stabilizers used or proposed in the United States, especially those of the Advance Solvents & Chemical Corp. containing organic tin compounds, including the latest types and interesting effects of stabilizer combinations. This article represents a reprint of the address held at the Duesseldorf Plastic Convention in October 1952.

LEAD STABILIZERS, C. F. Weider

In addition to the above address the author reports about the use of various types of lead stabilizers in the United States and Germany which fill the basic demand for high acid absorption and hence are suited to augment the heat and light resistance of PVC. Though thorough tests verified that stabilization of European made PVC types has to be executed more carefully than that of U. S. types and it would be hard to obtain the same favorable results as with the latter, it was stated that basic lead stabilizers are well qualified for the stabilization of European PVC types.

NEW UREA RESINS FOR THE PAPER INDUSTRY, Dr. Albert Petz

A brief history of urea resins is followed by a survey on present-day applicability of this fully synthetic material which is soluble in water and does harden only to a minor extent. Supplied in powder form and as concentrated aqueous solution as well as mixed with dextrine and animal glues, these resins are used primarily for gumming, labeling and on special bagging machines. Difficulties like after-condensation and limited solubility or pulling of threads have been overcome. New problems created by the steady improvement of industrial production ask for solution and will open up new combination possibilities.

HONEYCOMBS MADE OF POLYSTYRENE, W. Laeis

To overcome the shortage of beeswax in Western Germany, honeycombs are now injection molded from polystyrene. Small plates, 105 by 81 mm in size, showing approximately 320 cellular deposits with a wall height of 1 mm, are put together with binders for sizes actually needed. Long durability and sterility make up for the higher price which is about three times that of honeycombs of beeswax. Ready acceptance by the bees paid for this trial.

HIGH IMPACT STYROL AND CO-POLYMERS, P. M. Elliot

Abstracts from the article as appeared in the SPE Journal of February 1952.

FLUORO PLASTICS
O. Horn, W. Starck

This article is a reprint from "Angewandte Chemie," vol. 64 (1952)

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the Customers
of Newark Die

Molds ACCURATELY DUPLICATED FROM MASTER PATTERNS ON DIE SINKING MACHINES

In Keller machines like the one shown—one of a battery in use at Newark Die—a tracer passing over a master pattern automatically controls the movements of the feeding mechanism, which in turn governs the cutting of the mold.

Because of the delicacy of this electrical control when used by the skilled craftsmen at Newark Die, the finest of work can be done on the largest of molds.

Keller die sinking machines are typical of the many types of up-to-the-minute equipment now turning out molds to serve the customers of Newark Die.

NEWARK DIE COMPANY

22 SCOTT STREET, NEWARK 2, N. J.

Phone: MArket 2-3305

NDCO TRADE MARK

pages 533/36. —A history and description of the production process and the utilization of polytetrafluoroethylene and polytrifluoromonochloroethylene.

UTILIZATION OF POLYAMIDES AND POLYURETHANES FOR THE PROCESSING OF NON-RIGID PVC, Dr. Gerhard Beck

A proposal for the improvement of surfaces of non-rigid PVC products is made. Monomer diisocyanate and polyester components are brought into the PVC pastes at a certain ratio. Films made of such compositions adhere excellently to non-rigid PVC bases after gelatinization. The polyurethane adducts inlaid like pigments in such films have not reached the final addition stage. Isocyanate groups are still protruding from the film and are ready to react when brought into contact with NH-groups of polyamides and polyurethane solutions. Not only plastic foils and artificial leather, but also injection or compression molded articles have been rendered insensitive that way against manifold influences. Tissues have been covered with such films and did no longer show the disagreeable crease marks when crumpled. Nylon and Perlon which, due to the smoothness of these fibres, it was hardly possible so far to coat, showed that excellent adhesion can be produced when adding polyurethanes.

MOLDING TECHNIQUE FOR ACETYLCELLULOSE THERMOPLASTICS, Dr. W. Roehm

Since new type and qualities of thermoplastics on the basis of organic cellulose esters have been developed rapidly after the end of the war, a survey on the various points to be considered when molding this material is given, such as storage, pre-heating, design of injection cylinders, design of molds, molding temperatures, finish, etc.

FEED HOPPER FOR PRE-HEATING AND DRYING OF THERMOPLASTICS, E. Escales

A brief description of the "Continator" type feed hopper working on injection molding machines and extruders and produced by Messrs. Wilh. F. Hoffmann & Co. at Copenhagen/Denmark. The hopper has double walls and a built-in blower which, by means of heating elements, blows hot air through the perforations of the inner container into the molding material. Experience shows that the capacity of machines was thus increased by 20%. Provision is made for an air filter on the entry side and for a dust filter on the exit side. The inner hopper is equipped with strong magnets to attract iron parts so that such foreign matter would not enter the machine itself.

AIR BRUSHES FOR THE PROCESSING OF SENSITIVE PLASTIC DISPERSIONS

Since the coating of paper for the wrapping industry meets with a number of difficulties when using multiple roller coating machines, Messrs. Jagenberg of Duesseldorf have developed coating machines having one single roll with an air brush distributor device. Compressed air streaming forth between the adjustable air brush lips blows away the excess coating material, thus evening out the thickness of the coating and covering up all pores. Coating weights between 10 to 40 grams/sq.m. at speeds of 60 to 300 m/min. are attainable. The thickness of the coating may be varied by changing the air pressure and amount of air. A reasonable adjustability of the machine to the sundry viscosities of the materials is also possible. Special tunnel driers provided with infra-red radiator groups which may be switched individually, were developed to prevent premature formation of a skin on the film and, hence, appearance of bubbles. Two rolls arranged behind the drier serve to smoothen and densify the still hot coating.

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DER PLASTVERARBEITER

Vol. 4, No. 3, March 1953

Abstracter: E. C. Bernhardt

AIDS FOR CALCULATING THE COST OF INJECTION MOLDED PIECES by H. Spies

Illustration of how graphical methods can be used to speed approximate estimates for injection molded articles.

RUBBER—METAL BONDS BY THE "MEGUM" PROCESS by H. Kalpers

Brief description of a bonding process for natural or synthetic rubber employed by the "Kautschuk Gesellschaft m.b.H." in Frankfurt. The principal bonding agent is a solution of chlorinated rubber. The process is not recommended for copper, zinc or brass.

CLAMPING PRESSURE ON INJECTION MACHINES by H. Spies

A water-hydraulic system is described which employs a pressure transmission device to boost the line pressure three fold for final clamping, after the mold is closed.

A HINT by E. Mesalla

It is suggested that adapters and nozzles on injection machines be given a final tightening after the cylinder is hot, but before polymer is fed into the machine. To obtain the best seal, the cylinder should be slightly overheated while the nozzle is being tightened.

GRATINGS FOR INSULATING HEATED PRESS-PLATENS by K. Brandenburger

The life of laminated or multi-layer insulation is extended when the insulation is cut into rectangular strips which are placed parallel, and are spaced approximately ½" to 1" apart.

ACTUATING MECHANISMS FOR AUTOMATIC MOLDS FOR CAPS AND OTHER THREADED PARTS by H. Spies

A survey of various methods (gears, chains, etc.) which can be used to turn mandrels of multi-cavity injection molds to discharge molded parts.

WELDING WIH COUNTER ELECTRODES by J. Brandenburger

Counter electrodes permit the production of welds which may be embossed on both sides. Proper construction and installations of counter electrodes are described.

WELDING OF CELLULOSE ACETATE SHEETING

Common difficulties in welding cellulose acetate sheeting and a method for forming a beading around the edges of single sheets using high frequency welding equipment are described.

TRANSFER MOLDING WITHOUT SPRUE

A very sketchy illustration of two cases where such a process is employed. Reference is made to an article on sprue-less transfer molding which appeared in the PLASTVERARBEITER in October 1952. A very large diameter cold nozzle forms part of the mold. Material is heated in the cylinder by high frequency.

ADVANTAGES OF TRANSFER MOLDING

Transfer molding is not only faster than compression molding, but also facilitates flow around cores. Several common illustrations.

PIECING TOGETHER OF MOLDS

For the production of rectangular parts molds can sometimes be profitably built of individual slabs for each of the walls. A system for interlocking these slabs without the use of bolts is described. The idea for this system was originally published in the Spanish magazine "Revista de Plasticos" Vol. 3, No. 18, Page 369, Nov. 1952.

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GREAT BRITAIN

BRITISH PLASTICS, April 1953

Abstracter: Herbert R. Simonds

PLASTICS IN THE FOOD INDUSTRY (6 pages illustrated)

Plastics articles used in preparation and packaging of food and drink in 1948 in the United Kingdom were valued at more than £. 1,500,000. In

the f[illegible] years since then, the applications in this field have increased greatly. Many of the applications such as cups, dishes, and cutting boards are familiar. This article, however, describes some of the less well-known applications, particularly in the processing and preparation of food. P.v.c. coated conveyor belts are typical. These are used in candy and bakery plants for distribution of molten chocolate. Polyethylene piping is also used for conveying food products in process. Another use is the surfacing of ice cream machinery with laminates. Many of the properties of plastics are well suited for use in the food industry. Such properties are the non-permeable surfaces which can be cleaned readily by rubbing with a damp cloth, giving an advantage over material such as wood. However, there are some disadvantages and plastics formulation must be carefully studied to see that no harmful materials are used as stabilizers. For instance, with p.v.c. materials, zinc and lead, are sometimes used as stabilizers and these have a toxic effect if they get into the food. Accordingly, substitute plastics must be chosen. In general, such materials are available.

Some of the larger food manufacturers use jets of live steam to sterilize the plant and as yet the relatively low priced plastics materials are not proof against such treatment. However, many plastics can withstand sterilization rinses including the use of common detergents. In packaging, polyethylene is well established, especially in the refrigeration field. Inspection windows of processing equipment are quite generally made of acrylic sheeting. Conveyor belts are coated with p.v.c. The average band is about 42 feet long and 16 inches wide. The coating is supplied by calendering and is kept as thin as possible to assist rapid cooling. Another application used in food plants, but not necessarily limited to them is the coating of electric leads to various machines with flexible p.v.c. tubing which is expanded with compressed air and then collapsed onto the conduits. Baker's trays are made from a vinyl co-polymer sheeting pressed to form. Show cases offer a large use of both transparent p.v.c. sheeting and transparent acrylics. Acrylic sheeting is used for covers for butter as well as for display stands to hold packaged food.

NEW INSERT TECHNIQUE CUTS PRODUCTION COSTS

(2 pages illustrated)

An advantage of molding over machining is the ease in which inserts may be incorporated into a molded product. Typical are the familiar electric plugs, especially, bases for radio and t.v. tubes. This article describes some new methods of economy in placing of inserts. A study was made by the McMurdo Instrument Co., Ltd., manufacturers of tube bases (known in England as valve holders). This company analyzed each insert to determine the most efficient method of applying it. In the case of the mounting plate, the operation was redesigned so that the metal piece was not an insert at all, but a separate stamping with projecting lugs, which later was applied by crimping into place in a channel in the molding. This crimping was done by hand operated presses at the rate of 450 per hour. The question pointed out by the article is whether or not to use inserts. Sometimes it is more economical to apply metal parts after molding.

THE CURING OF EPOXIDE RESINS

by E. S. Narracott, Shell Petroleum Co., Ltd. (3 pages)

Further research in the chemistry of epoxide resins is needed before a full report can be made of their remarkable properties. This article concentrates on the methods of curing which have proved important to the plastics industry. Historically, the curing of epoxide resins with amines was first disclosed in a patent by I. G. Farben Industries. Later, Castans in Switzerland discovered cures by a catalytic action. This method was patented by Ciba. Epoxy resins are formed by reaction of a diphenol with epichlorhydrin in the presence of caustic soda. Much additional experimental work has taken place since these early developments. The question remains however as to which type of curing resin should be employed. For example, with primary diamines the proportion of amines required to give optimum properties in the cured resins is critical. Reference is made to Epikote resins marketed by the Shell Group. The curing of epoxy resins with tertiary amines is affected catalytically through polymerization through the epoxy groups. One field for further investigation is the use of acid curing agents. It is known for example that acids and complexes formed between boron trifluoride will cure epoxide resins with unusual rapidity. Further information on this is contained in the "Official Digest" for July 1952. High molecular weight epoxy resins can be cured by reaction with urea formaldehyde or phenolic resins at temperatures in the range 150-200°C.

The conclusion which is reached from these observations is that the conversion of epoxide resins into surface coating films involves the hydroxyl groups present in the epoxide resin and that the presence of epoxy groups may, in fact, merely result in consumption of some of the effective curing agent in the form of an ester.

The epoxide resins may be regarded as still in the development stage, but they are destined to be accepted eventually as one of the main types of resin available to industry.

P.V.C. FOR BATTERY SEPARATORS (3 pages illustrated)

Vinyl chloride polymer in unplasticized powder form is mixed with dried corn starch. A typical formulation is 75 lb. starch, 15 lb. p.v.c., 29 lb. dimethyl cyclohexanone. The batch is put into a reflux condenser where it is heated and mixed, after which the dough is transferred to a ram extruder. The material used for battery separators is extruded in double widths which are then passed through two rollers which impart the necessary ribbing. Such materials are rapidly replacing ribbed wood for use as battery separators.

BRITISH PLASTICS EXHIBITION, 1953—OLYMPIA, LONDON, JUNE 8TH-18TH.

Some of the papers summarized are as follows:

Problems Related to the Manipulation of Unplasticized Polyvinyl Chloride, by J. J. P. Staudinger, Dr. Ing., Director, British Resin Products.

Industrial Applications of Unplasticized p.v.c. by J. S. Byers, Technical Service and Development Dept., Imperial Chemical Industries, Ltd.

Recent Commercial Development of Melamine and Guanamine Resins, by F. J. Mills, Technical Sales Manager, Chemicals Division, British Oxygen Co., Ltd.

Molded and Extruded Polyamides and Polyesters, by W. C. Fergusson, Imperial Chemical Industries, Ltd.

Silicones in the Plastics Industry by J. H. E. Jeffes, Mgr. Technical Service Dept., Midland Silicones, Ltd.

Surface Chemistry and Adhesion of Glass and Plastics by H. Cole, Deputy Chief of Research, Pilkington Brothers, Ltd.

Plastics Containing Asbestos as a Reinforcing Filler by P. H. H. Bishop, J. E. Gordon, and P. L. McMullen, Royal Aircraft Establishment, Farnborough.

A Critical Survey of Commercial Low-Pressure Laminating Resins by V. E. Yarsley, and A. G. Goodchild.

Some Considerations in the Design and Manufacture of Structures in Glass Reinforced Material by G. C. Hulbert, Bristol Aeroplane Co., Ltd.

Some Problems Associated with the Design and Manufacture of Asbestos Reinforced Plastics Structures, by D. S. Bancroft, F. G. Miles, Ltd.

The Durability of Plastics Under Post Office Conditions by A. D. W. Downes, and A. A. New, Research Branch of the Post Office Engineering Department.

The Durability of Adhesives for Wood, by R. A. G. Knight, Forest Products Research Laboratory.

The Metal Coating of Plastics by Vacuum Evaporation for Functional and Scientific Purposes by L. Hol-

land and N. Sutherland, W. Edwards & Co.

Flame-Proof Conveyor Belting by S. J. Skinner, British Geon, Ltd.

PLASTICS APPLICATIONS
(4 pages illustrated)

Among the new items listed this month are:

Acrylic lighting fixtures
Nylon bobbins for film
Polyethylene cable straps
Photographic laboratory dishes

ACRYLIC CORNEAL LENSES
(1 page illustrated)

These lenses are less than ½ inch in diameter and are very light. They are being made in Australia as an advance on conventional contact lenses.

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PLASTICS

March 1953

Abstracter: A. T. Rexer

RELIEVING STRESSES IN POLYSTYRENE BY HEAT TREATMENT by E. E. Halls

A short article which describes heat treatment methods for stress-relieving polystyrene components prior to machining.

PLASTICS IN THE SERVICE OF MAN

A pictorial review of high-quality units molded or otherwise fabricated in Great Britain.

VINYL-TYPE POLYMERS IN SURFACE COATINGS by W. A. Edwards

A two and one-half page article describing the present uses of a number of thermoplastic vinyl-type polymers that have been firmly established in the surface coating industry. The following materials are covered: polyvinyl butyral, polyvinyl acetate, vinyl acetate-chloride copolymers, styrene, methacrylic esters, and copolymers of styrene with drying oils.

NEW PRODUCTIONS

Descriptions and illustrations of several new plastic items now being produced in Great Britain.

EDWARDS VACUUM COATING PLANT

An article illustrating and describing the Edwards Model 24E Vacuum Coating Plant which has been designed especially for the bulk metallizing of plastics. The evaporative technique employed in this model involves the electrical melting and vaporizing of the metal at a pressure of 10^{-4} mm. of mercury or lower, and the subsequent condensation of the vapor on the surface to be coated.

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UNITED STATES

Abstracter: J. J. Lamb

EFFECT OF DIFFERENT CATALYSTS AND AMOUNTS OF STYRENE MONOMER ON STRENGTH AND DURABILITY OF GLASS-CLOTH PLASTIC LAMINATES

Forest Products Laboratory Report No. 1825, by A. A. Hohaupt and A. D. Freas, March 1952

Glass fabric polyester laminate panels were made using 14 combinations of molding temperature and amounts of catalyst, promoter, and styrene. These molding temperatures were 75, 160, and 250F, and the amounts of catalyst, promoter, and styrene ranged up to 1.8, 7.2, and 33 percent, respectively. Parts of the panels were exposed to nine different sets of ambient conditions including outdoor exposure, humidity cycling, water immersion, and high temperature. These were tested in flexure at 73F afterwards, but those exposed to the high temperatures, 160 and 350F, were tested at those temperatures.

There were no marked effects of varying the amounts of catalyst or styrene. The panels molded at room temperature with premotors were least affected by outdoor weathering. Some panels had decreases of 30 percent in flexural strength after 6 months outdoor weathering, but in no case was this decrease less than that caused by 30 days water immersion, which was usually 30 to 40 percent.

(Copies of these reports may be obtained on request to U. S. Department of Agriculture, Forest Products Laboratory, Madison 5, Wisconsin)

MECHANICAL PROPERTIES OF SOME LOW-DENSITY MATERIALS AND SANDWICH CORES

Forest Products Laboratory Report No. 1826, by A. W. Voss, March 1952

Tests were made on honeycomb cores of glass fabric, cotton fabric, paper, and aluminum and a plastic foam. Shear and compression tests were made on the cores alone, and also with the cores as part of a sandwich with glass fabric polyester faces. Densities of the cores ranged from 4 to 11 lb/cu. ft. High-density glass fabric honeycomb had a compressive strength of 1,200 psi and a shear modulus of elasticity of 120,000 psi; comparable values for high-density aluminum honeycomb were 1,000 and 420,000 psi.

This report is a continuation of tests made in FPL Report No. 1805 on different samples. The test methods are described in FPL Reports Nos. 1555 and 1556.

ELECTRICAL MANUFACTURING
Vol. 51 No. 4 April 1953

Abstracter: Gerald Eisner

CHEMICAL STRUCTURE EFFECT ON PLASTIC DIELECTRIC PROPERTIES—Henry M. Richardson

Mr. Richardson analyses dielectric constants and dissipation factors in relation to the type of molecular chains of 43 different plastic materials. Subsequent discussion reveals the importance of fillers and additives. Finally, moisture absorption and aging characteristics are considered for their effects on dielectric properties.

Reprints of this valuable article can be obtained from The Gage Publishing Co. 1250 Sixth Ave., New York.

Toledo News

John C. Purdue

Mr. R. D. Sackett of Monsanto was the featured speaker at the April 29 meeting of the Toledo Section. Mr. Sackett spoke on "High Impact Polystyrene Molding Compounds." He began by noting that the sale of 2½ billion pounds of plastics for the year 1952 was a 50 per cent increase over 1951, and was attributable to the use of large capacity molding machines, improvements in raw materials, and improvements in engineering and design techniques. Mr. Sackett estimated that the television and air conditioning industries will use 300 million pounds of polystyrene in 1953. The use of polystyrene in these industries would probably be impractical, notwithstanding its low cost per cubic inch, if the high impact material were not available. Mr. Sackett pointed out that high impact polystyrene differs from "ordinary" polystyrene also in having a higher heat distortion temperature, but that its flexural and tensile strengths are lower. It was pointed out that the impact strength as determined by the notched bar Izod test is a function of the size of bar used for the test, and that substantial variation in results from the same material can be noted by using bars or different sizes.

SECTION NEWS

Edited by
Stanley Bindman
Jamison Plastic Corp.
71 E. Sunrise Highway
Freeport, New York

Thomas E. Orr Awards Given by Akron—Cleveland Section; Speakers on Mixing, Weigh-Feed

F. A. Martin

Two speakers were featured at the Cleveland-Akron Section meeting on May 11 at the Spanish Tavern in Brecksville. Mr. James L. Foster, of B. F. Goodrich Chemical Company spoke on "Vinyl Powder Mixing." Mr. Foster prefaced his talk by citing equipment costs for various methods of compounding, based on 1,000 to 1,500 lbs. per hour production. For example, a Banbury set-up would cost in excess of $100,000, while mill mixing equipment would be approximately $80,000. In contrast dry blending equipment for the same capacity would cost from $5,000 to $20,000. These figures basically explain the current wave of interest in dry-blending.

There are four basic requirements for a good dry blend, which are: (a) it should have a dry sandy feel. Particle size and shape of the resin are the most important factors in controlling dryness; (b) the resin particles must be uniformly plasticized, otherwise "fish-eyes" will predominate in the subsequent extrusion; (c) all other ingredients must be uniformly dispersed; and (d) the blend must be dry and free-flowing. A properly prepared dry blend will extrude at nearly double the rate of a poorly dispersed, damp powder mix.

Four general types of mixers may be used to prepare dry blends of acceptable quality. These are tumble mixers, ribbon blenders, internal mixers, and mullers. All require a heating method to drive the plasticizer into the resin. In general, the resin is first heated, after which the plasticizer is added and the mixing continued until the resin absorbs the plasticizer. At this point the fillers and other ingredients may be added.

Extrusion of dry powder mixes may require some modifications of extruder equipment. No fixed rules can be stated, but Mr. Foster gave some general tips to guide the extruder operators. The screw length should be 17 to 20 times the diameter, with a compression ratio of 3.5 or 4 to 1. The screw should be of the decreasing depth type. Denser screen packs then are used for granular compounds and are valuable in building up back pressure. In general, the rear zones are run cooler to avoid air entrapment, with higher front zone temperatures. Powder mixes are generally found to extrude up to 20% faster than comparable granular compounds.

The second speaker was Mr. James Curry, Vice President of the Glengarry Corporation. Mr. Curry demonstrated their weigh-feeder, giving the background of its development, and citing the experiences of some of the users of the five hundred units now in the field. The machine as demonstrated delivered consecutive shots of material with a maximum of 0.2 gms. variation on a 160 gram setting. This corresponded to 6 or 7 cubes of the polystyrene being weighed.

This meeting concludes the series of spring meetings. On June 11 the annual section golf outing was held at Lake Forest Country Club, with golf and outdoor recreation in the afternoon, followed by dinner.

THOMAS E. ORR AWARDS

Mr. David J. Sloane, Cleveland president, made the presentation of the second annual Thomas E. Orr awards during the meeting. These awards consisting of a Junior Membership are made to students at Case Institute of Technology and the University of Akron. The recipients are selected by the faculty on the basis of scholarship, interest in or work with plastics, and other personality factors. The purpose of the awards in addition to commemorating the activities of Mr. Orr on behalf of S.P.E., is also to interest young chemists and chemical engineers in making a career in the plastics industry.

The Case award was presented to Mr. John M. Flynn, who is completing work for his master's degree. Mr. Flynn has just completed his thesis on "Polymerization of Styrene in the Presence of Carbon Black."

The University of Akron recipient was Mr. James R. Purdon from the Junior class. Incidentally, Mr. Purdon's father has been with B. F. Goodrich for twenty-two years and is engaged in plastics work.

Plaques bearing the name of each annual award winner have been obtained for each of the schools. That for Akron was presented on May 12 at an assembly of all chemistry students by Frank A. Martin on behalf of the section.

Polyesters Are Discussed at West New England

E. J. Sweeney

The May dinner meeting of the Western New England Section was held at the Ashmere Inn in Windsor Locks, Connecticut on May 6th. Mr. Paul Holmberg, Section Vice President turned the meeting over to Ray Mazur following the dinner.

The subject for the evening was "Polyesters." Ray introduced the speakers giving a short resume of their background. Dr. Elliot of the Naugatuck Chemical Company showed slides and explained the manufacturing of both the resin and glass-resin laminates. He demonstrated the methods used to cure the material, passing around the finished laminate and cured resin.

Mr. Dave Burmingham of Colts Manufacturing — Plastics Division, spoke on typical problems involved in developing a molded part. The problems involved indicated the great amount of special know-how required in glass polyester molding.

The program was completed with the showing of the Owens-Corning Fiberglass movie, "The Magic Marble."

This meeting was very well attended.

Weigh Feeding and Temperature Instrumentation Topics Presented At Newark

Don Biklen

Ninety-five members and guests heard two timely topics at the May S.P.E. meeting held in the Military Park Hotel, Newark, N. J.

Mr. Ed Buechner of the Glengarry Processes, Inc. described the principle behind the Glengarry unit. A weigh beam is controlled by weights and a vibrating trough regulates the flow of material into the weigh pan. The speaker pointed out that it is better to operate the flow as slow as possible since a lesser number of granules of material will be in the air when the weigh pan approaches the designated weight.

The major advantage in using a weigh feeding device is the accuracy in weight control on the molded piece. Without weight control, the cavities are packed, resulting in a heavy piece containing stresses and strains. Mr. Buechner cited an example where 7 grams of material were saved on each shot weighing 7 oz. Although the part was lighter, tests showed that the part was stronger than an identical part molded on a machine not using a weigh feeder. It was also found that the lighter part was free of strains.

Another example was told of a molder running wall tile on two machines. By using the weigh feeding device, he found his tile to be more uniform in dimensions, so much so that he had to shut his other machine down until a second weigh feeder was installed.

Naturally, there is skepticism among the molders to invest in such a unit. However Mr. Buechner pointed out that there are 100 plants operating these units and in a matter of 3 to 4 months, the savings in material, less rejects, and higher production has justified the investment. Mr. Buechner had a unit at the meeting and demonstrated it to the audience.

Mr. Richard West, president of the West Instrument Co. of Chicago gave a very timely talk on Practical Instrumentation for the Plastic Industry. Temperature control is important where optimum properties are to be obtained from a material — temperature too high, the material burns or breaks down; temperature too low, poor fusing and or a short shot results. The speaker pointed out the need for close temperature control in the packaging field. If the seal is no good, the customer will reject the entire lot of packaged goods and this can be expensive where the item packaged is perishable.

The on-off type of control is objectionable due to the wide range beyond the setting. On the upper setting the thermal inertia carries the temperature beyond the setting and in certain cases, this can be objectionable. The proportioning type of controller anticipates the top setting and turns off a little ahead of time. This results in a much closer operating range.

Mr. West described the proportioning type of unit that his company was making. It is based on the magnetic amplifier principle and no tube is used. The German Army and Navy had been using this type for quite some time and found them to be highly successful. The maintenance required on this magnetic amplifier type is negligible.

The speaker told of a company that operated a furnace at 1550°C and could not control the temperature less than plus or minus 25°C. A proportioning type controller was put in and the control was brought down to plus or minus 5°C.

A lively question period followed the second speaker.

Personals

Art Warner will go to Sweden in August and attend a meeting of the International Standards Organization. Mr. Warner is the S.P.E. National Representative.

Newark S.P.E. regrets the loss of Dr. Axin from its membership. He has been transferred to Chicago by DuPont.

The new program chairman for the coming year will be Ed Soules of Detroit Mold Engineer Co., Hillside, N. J. Don Biklen ends his chairmanship duties in June.

The September meeting will be on the ninth.

Preplasticizing and Extrusion are Topics At Connecticut

David Mersey

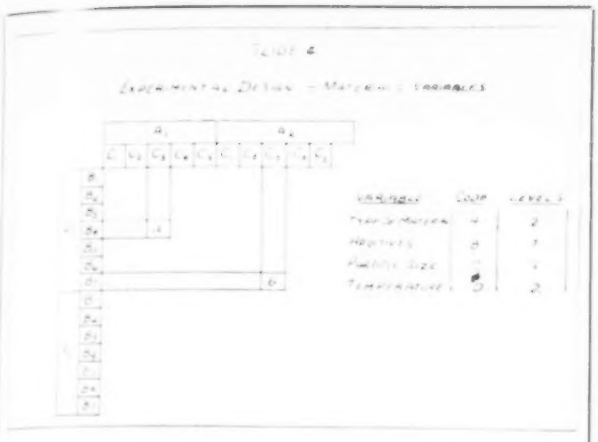
April's meeting was held at Bridgeport, where Mr. R. W. Powell of HPM presented an excellent program on 'Pre plasticizing.' He and Frank Smith showed the evolution of preplasticizing through the earlier stages of the 'tunnel machine,' and then the use of the 'pineapple.' In the present stage, the molding compound is completely plasticized before coming into contact with the injection plunger. Through the use of slides, they were shown the changes and resulting advantages in the newer presses such as, increased shot and plasticizing capacities; the elimination of stresses and strains in molded parts; economies in weight and material costs; lower molding temperatures; reduced clamp pressures; better color dispersions; better mold release.

Jumping from injection to extrusion, at the May meeting, Mr. Milton Greenhalgh of GE, presented a program called 'Extrusion Trends.' He first described the function of the various parts of an extruder; then delved into the various problems which might arise from moisture, trapped air, volatiles, stabilizers. The trend today is toward extruders with screws of longer length and larger diameters, but with slower worm and feed speeds. As part of the same program Rene Magnenat of the Waterbury Companies pointed out some of the problems arising in tool design. The first problem being that of alignment, where it is necessary to allow for working tolerances and thermal expansion. Then, he showed the various ejection pin systems and methods.

Strictly on our own, we have been doing a survey of the magnitude of the plastics industry in this State. This raises the problem as to where the term 'plastics' starts and stops. Another problem is area. We have gone beyond that covered by the Connecticut Section and covered the whole State. Connecticut is in a peculiar situation or location; it is situated between two large production areas, Massachusetts and New York-New Jersey. These figures are not complete coverage, but represent a minimum. From the time of this compilation to the time of this writing there have been a few changes, both additions and subtractions. Hence, we call this a minimum.

We found the following numbers of organizations prepared to do these operations on a production level. Forty (40) do compression molding; thirty-five (35) injection; six (6) extrusion. Eleven firms manufacture cast or calendered film and sheeting; seven (7) coated fabrics. Fourteen (14) coat wire by extrusion; this excludes various liquid applications. Eight (8) manufacture finished compounds for molding or extrusion; five (5) manufacture resins. Again, this does not cover all applications, and is not complete.

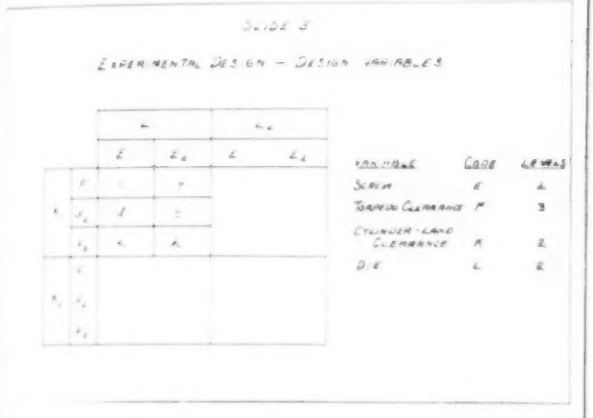
As part of the same project we found some unusual place names. We could not find a place called 'Last Word,' but we did find, above all, a village called 'Above All.'



SLIDE 4

EXPERIMENTAL DESIGN – MATERIALS VARIABLES

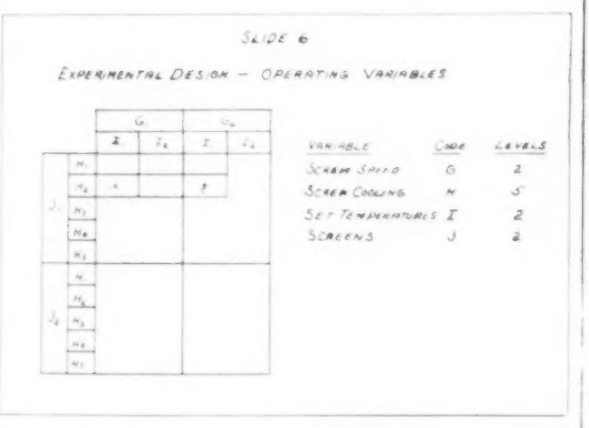
VARIABLE	CODE	LEVELS
TYPES OF RESIN	A	2
ADDITIVES	B	7
PARTICLE SIZE	C	5
TEMPERATURE	D	2



SLIDE 5

EXPERIMENTAL DESIGN – DESIGN VARIABLES

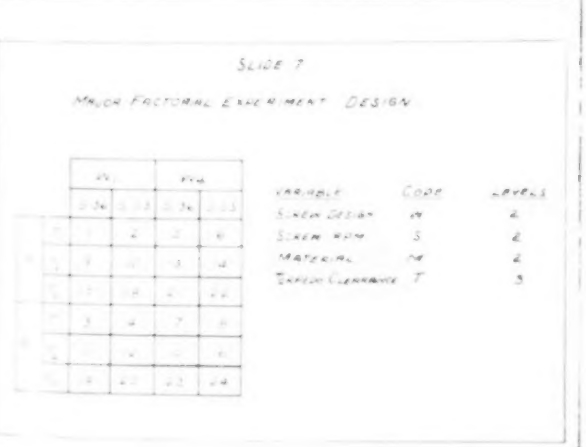
VARIABLE	CODE	LEVELS
SCREW	E	2
TORPEDO CLEARANCE	F	3
CYLINDER-LAND CLEARANCE	K	2
DIE	L	2



SLIDE 6

EXPERIMENTAL DESIGN – OPERATING VARIABLES

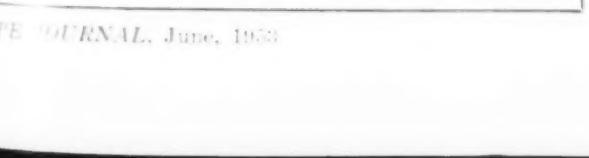
VARIABLE	CODE	LEVELS
SCREW SPEED	G	2
SCREW COOLING	H	5
SET TEMPERATURES	I	2
SCREENS	J	2



SLIDE 7

MAJOR FACTORIAL EXPERIMENT DESIGN

VARIABLE	CODE	LEVELS
SCREW DESIGN	M	4
SCREW RPM	S	2
MATERIAL	M	2
TORPEDO CLEARANCE	T	3



STATISTICAL ANALYSIS

(Continued from Page 17)

relating empirically many factors which contribute to the success or failure of an extrusion process.

In the next sections of this paper ten of the following variables will be considered.

Variables	Number of levels*
1. Materials	
a. Types	2
b. Additives	7
c. Particle sizes	5
d. Temperatures	2
2. Design	
a. Screws	2
b. Torpedo clearances	3
c. Cylinder land clearances	2
d. Dies	2
3. Operating	
a. Screw speeds	2
b. Screw cooling	5
c. Set temperatures	2
d. Screens	2

*The **number of levels** of a variable is the expression used to specify the degree of variation for the particular variable.

A full factorial design for these twelve variables at the specified levels would comprise 134,400 experiments. At the rate of 4 experiments a day it would require more than 100 years to complete this work. Actually 57 experiments were completed while investigating ten of the twelve variables.

Experimental Design

The particular variables within each of the three general groups were arranged in conventional factorial design as shown in the next slides. Slide (4) lists the materials variables. The two formulations described by box (a) and box (b) were selected to be incorporated into the structure of the major factorial experiment. The variables temperature and particle size were incorporated in the corollary experiments to be described.

Slide (5) lists the design variables. The screw design and torpedo clearance variables were selected for incorporation into the major factorial experiment. Six of 24 possible experiments, (c), (d), (e), (f), (g), and (h), were chosen for study.

Slide (6) lists the operating variables. The conditions described by boxes (i) and (j) were selected to be incorporated into the major factorial experiment. The variables, set temperatures, screw cooling, and screens were investigated in the corollary experiments.

Slide (7) shows the structure of the major factorial experiment involving five variables. Two of these, the materials variables, have been combined and classified as two levels of a single variable called **M**. It will therefore be necessary to discriminate between these two potential sources of variance. Note the change in nomenclature in this slide. The variables are given letters and numbers which are more descriptive of the actual experiment. The differences between screw W-1 and screw W-4 involved both helix angle, compression ratio, cylinder-land clearance and the length of the flighted section. The screw speeds were 36 and 53 RPM. The torpedo clearance variable was the radial distance measured from the surface of the discharge end of the extrusion screw which did not have flights to the surface of the extruder barrel. This distance was increased by machining the torpedo to

a smaller diameter. Radial distances of 3 32", 1/8", and 11 64" were used. The number in each of the 24 blocks is the code for that particular experiment.

Slide (8) shows the structure of the corollary experiments and relates them to the major factorial design. Eight experiments, nos. 25 thru 32, were completed to evaluate screw cooling. Eight experiments nos. 33 thru 40, were run to evaluate particle sizes. Twelve experiments, nos. 41 thru 52 were run to evaluate the several additives.

Two experiments were run with the feed material heated to about 185°F. These runs were coded nos. 53 and 54 and were related to major factorial experiments 10 and 14. The set temperatures along the extruder barrel were changed 100°F for experiments 55 and 56. These experiments were based on major factorial experiments nos. 9 and 15. The effect of screens was evaluated by a single experiment, no. 57, which was based on the major factorial experiment no. 14.

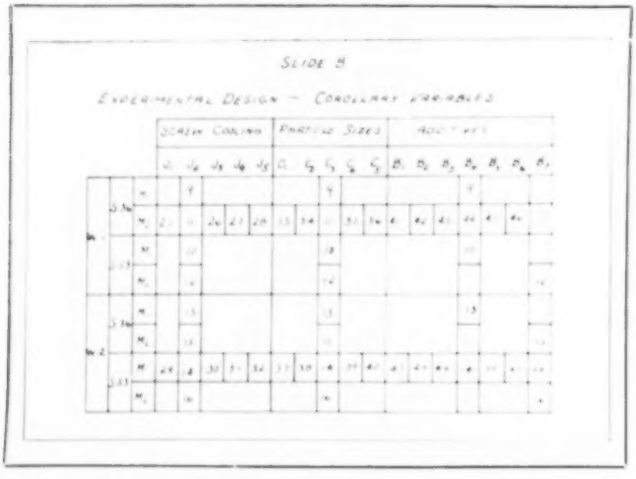
In summary, two of the twelve original variables were not considered. Fifty seven of the potential 33,600 experiments, 0.17% of the total, were completed.

Details of the Experiment

A Monsanto Design #7 production extruder was used for these tests. Extrusion rates were measured at the packout station with three separate checks of twenty minutes duration for most tests. Power measurements were continuously recorded by an Esterline-Angus Recording Wattmeter installed on the drive motor circuit. At the end of each run stock temperatures were measured at three positions across the face of the die using a Pyrocon thermometer. Other data were recorded several times during the conduct of each test. It was not considered necessary to randomize the sequence of the experimental runs since the equipment was used for normal production between each group of four tests. It is quite likely that a more efficient statistical arrangement of the corollary experiments could be devised. Actually it was not feasible to attempt this because of the limited time allotted for the work. The corollary experiments as performed required a minimum of additional time since only one variable was changed between tests. The data are presented in table I and are summarized in table II.

Analysis of the Data

The data for experiments 1 thru 24 were subjected to the conventional analysis of variance. Separate results were obtained based on the rate of extrusion, input power, and material temperature. One could further extend such an analysis with data for other measured variables. These might include quality aspects (color, porosity, size tolerance), physical properties (impact strength, tensile



Experimental Data for Statistical Analysis of Extruder Performance

TABLE I

CODE NO.	RATE # HR.	POWER HP	STOCK TEMP. °F.	# HP. HR.
1	200	23	445	8.7
2	255	33	480	7.7
3	235	24	435	9.8
4	290	34	455	8.5
5	270	26	448	10.4
6	355	38	466	9.3
7	300	27	440	11.1
8	400	40	465	10.0
9	225	24	455	9.4
10	275	35	480	7.8
11	280	24	440	11.7
12	325	35	465	9.3
13	290	25	442	11.6
14	365	38	460	9.6
15	320	26	435	12.3
16	400	39	450	10.3
17	235	23	445	10.2
18	290	34	465	8.5
19	270	24	430	11.3
20	355	36	465	9.9
21	300	26	435	11.5
22	380	39	440	9.7
23	325	27	430	12.0
24	385	40	435	9.6
25	330			
26	275			
27	250			
28	185	24		7.7
29	410	38		10.8
30	365			
31	350			
32	275			
33	295	25		11.8
34	285			
35	285			
36	290	23		12.6
37	385	38		10.1
38	370			
39	375			
40	385	35		11.0
41	290	28		10.4
42	230			
43	235			
44	230	22		10.5
45	220			
46	240			
47	425	44		9.7
48	365	39		9.4
49	370	38		9.7
50	355	39		9.1
51	375	39		9.6
52	415	40		10.4
53	325	35		9.3
54	415	38		10.9
55	225	26		8.6
56	320	28		11.4
57	360	38		9.5

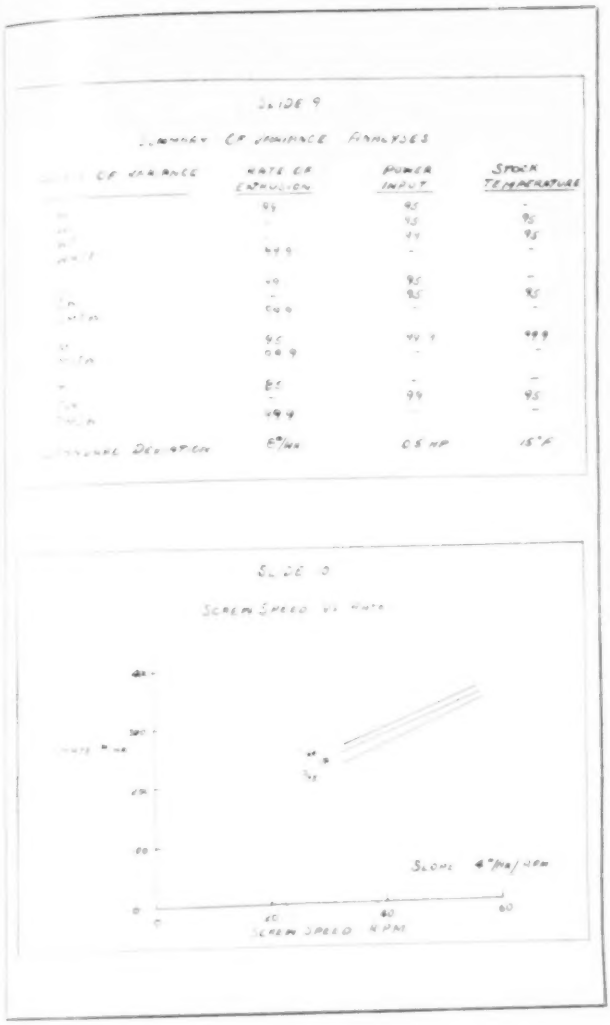


TABLE II

SUMMARY OF FACTORIAL EXPERIMENT DATA

FACTOR	RATE = HR.	HP	STOCK TEMP.
Grand average	305	31	450
W-1	270	29	455
W-4	340	32	445
S-36	270	25	440
S-53	340	37	460
M_1	285	30	455
M_2	325	31	445
T_1	290	30	454
T_2	310	30	453
T_3	320	33	443
σ (standard deviation)	8	0.5	15
Δ for $N = 1$ *	16	1.0	30
Δ for $N = 8$ *	6	0.4	10

* 0.98 σ divided by the square root of n = difference for 95% confidence level where N is the number of individuals compared.

strength, etc.) and other particular application properties. When one assigns arbitrary scales to the measured variable the analysis of variance by rank may be used instead of the conventional analysis of variance.

Slide (9) shows a summary of the variance analyses for the major factorial experiment data. The sources of variance are listed in the first column. Of the fifteen possible sources seven were found to contribute to the overall variance. The numbers in the next three columns are significance levels. For example the first number 99 means that 99 times out a 100 one will be correct in stating that the screw design was a significant source of variance influencing extrusion rate. The magnitude of the variance is obtained from the data and is not necessarily related to the significance level. A fixed reference is not used in the analysis of variance. It is quite common to accept a significance level of 95 or higher on which to base decisions. When a higher degree of certainty is required the expense of experimentation may be increased.

It is interesting to note that no significant two or three factor interactions influencing the rate of extrusion were obtained. Three of the main variables were significant sources of variance for extrusion rate. The fourth, torpedo clearance, contributed a variance of the same order of magnitude as the experimental error and it would therefore require more extensive data to discriminate between the torpedo clearance effect and the experimental error unless one were satisfied with the odds of 85 out of 100.

Four significant interactions were obtained, two for power variance and two for stock temperature variance. The four factor rate interaction has not been interpreted. Continued discussion of these results is more easily followed using the actual values of the data. The following graphs are plots of the averages of all variables except those which are used as parameters in the plots.

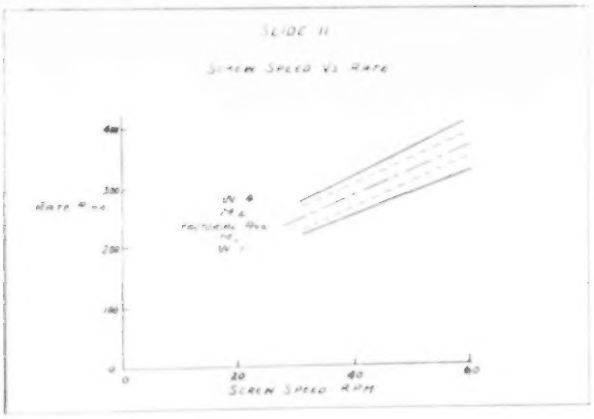
In slide (10) extrusion rate has been plotted as a function of screw speed with torpedo clearance as the parameter. There is no significant difference in slope for the lines and the increased rate with increasing RPM and increasing torpedo clearance is what one would predict. An incremental rate of 4" HR. RPM was obtained.

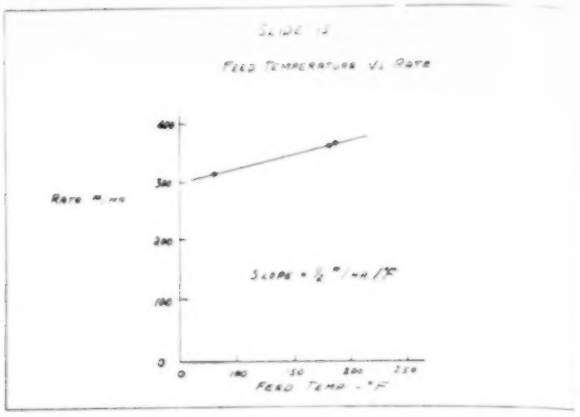
In slide (11) extrusion rate is plotted as a function of screw speed with material and screw as parameters. The difference between the two screws is about twice that between the two materials. The change in rate with varying screw speed is independent of either screw or material. The interactions are not significant.

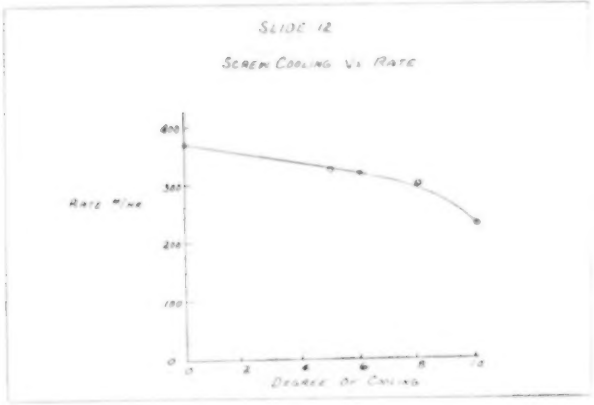
In slide (12) rate of extrusion is plotted as a function of the amount of cooling applied to the screw. Zero on the abscissa represents no cooling and 1.0 represents the maximum cooling available. The reduction in rate of extrusion increases when the degree of screw cooling is increased. Screw cooling was also found to influence several quality factors and the power consumption.

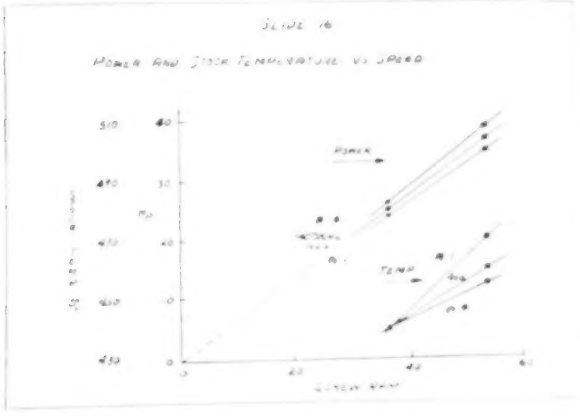
In slide (13) extrusion rate is plotted as a function of particle size on an arbitrary scale. The coarseness of the feed material increases from left to right. There is no significant difference in extrusion rate over the range of particle sizes tested.

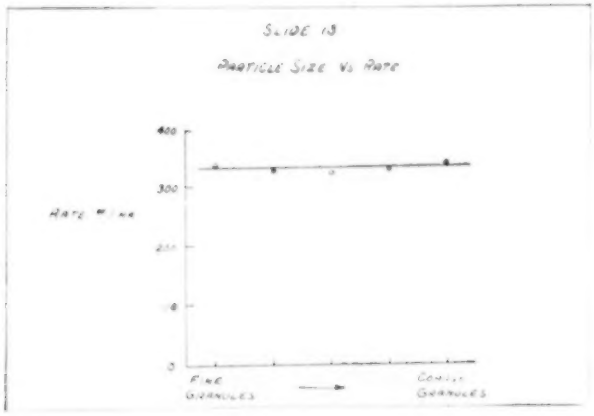
In slide (14) rate of extrusion is plotted as a function of the percentage of additive. This plot is one of the more interesting results in that a minimum was obtained. Had these tests been performed using 0% additive and 1% additive only, one might conclude that the rates of extrusion were not influenced by the amount of additive. In other tests, not presented, it was shown that the significant difference between the two materials used was

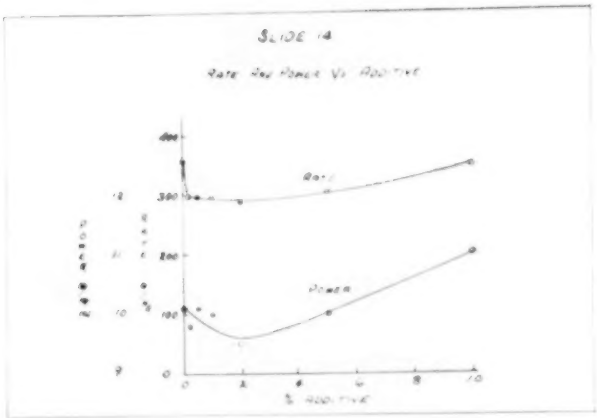












dependent upon the percentage of additive and not on the type of material.

In slide (15) the rate of extrusion is plotted as a function of material temperature as charged to the extruder. An increase in extrusion rate of $\frac{1}{2}$ # HR F was obtained with increasing temperature.

The variables set temperatures and screens did not contribute a significant variance to the extrusion rate. Power consumption increased with decreasing set temperatures and stock temperature differences were of the same order of magnitude as the experimental error.

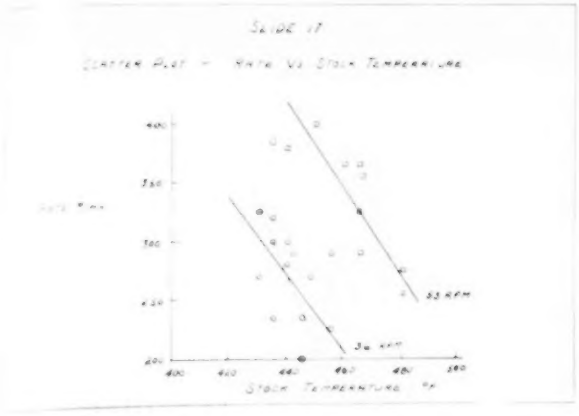
There are many additional ways in which these data can be compared. The relationships between power, speed and stock temperature are presented in slide (16). In each case the screw by speed interaction was found to be significant.

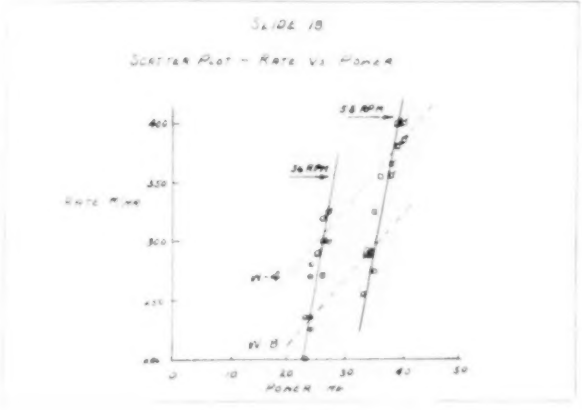
The last three slides, (17), (18), and (19), are cross plots between the three measured variables. These are sometimes called scatter diagrams. Statistical techniques can be used to determine if valid relationships exist between these variables. The correlation coefficients and lines of least squares were calculated in several instances.

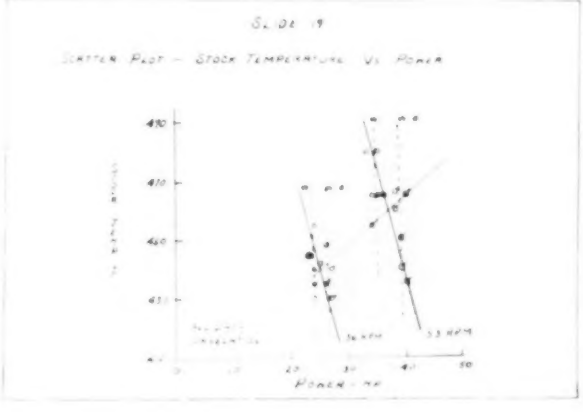
In slide (19) stock temperature is plotted as ordinate and power as abscissa. Based on all of the data one can conclude that an increase in power input will result in an increase in stock temperature. But if the RPM is held constant one obtains a reduction in stock temperature with increasing power input. For a particular screw at constant RPM the power is not dependent on the stock temperature.

Summary and Conclusions

Three concepts are expressed or implied in this paper. First, anyone can take advantage of that which statistics







has to offer. If a reasonably simple experimental design is used, the analysis of variance can be obtained directly from the pattern of plus and minus diagrams. The analysis of variance by rank is equally simple. Complex designs should be developed and treated by experienced statisticians. Secondly, one can study a complex operation such as extrusion with facility even though the variables can not be related analytically. And third, the practical goal of any experimental work is to improve quality, reduce cost, increase capacity, or develop new products. This goal can be achieved without completely understanding the absolute relationships between the variables. There is most certainly a practical limit beyond which one can not afford to attempt a theoretical solution to a problem. Extrusion as a whole may be beyond that limit although we can profit greatly by idealized theoretical studies of particular aspects of extrusion.

These factual conclusions can be obtained from the experiments which were discussed.

1. Screw W-4 had a 25% higher extrusion rate than screw W-1. This was attributed primarily to its lower compression ratio.

2. A 50% increase in screw speed resulted in a 25% increase in extrusion rate. This was equivalent to 4# HR - RPM.

3. Material containing 0.0% or 1.0% additive had a 20% higher rate of extrusion than material containing 0.1% additive.

4. The particle size of the feed material did not influence the rate of extrusion.

5. Screw cooling reduced the rate of extrusion.

6. Increasing the temperature of the feed material increased the rate of extrusion by ½# HR °F.

7. The effects of the variables on extrusion rate were additive, that is all of the separate effects could be combined to give a maximum rate of extrusion.

8. Although not evident from the data presented it was found that in general when one increased the rate of extrusion the quality level was reduced. One must balance such results in defining the optimum mode of operation.

Acknowledgements

The work described in this paper represents the cooperative effort of many individuals. In particular, the contributions of G. Noel in the conduct of the experiments, G. Osterman in scheduling and production services, and the Monsanto Statistics Department are gratefully acknowledged.

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Plastigels

(Continued from Page 15)

nent. Rejects or scrap in the unfused state may be remolded.

Embossing

Plastigels may be embossed with intaglio or bas relief designs using low pressures. An example of a sheet of plastigel embossed with an intaglio rolling pin is shown in Fig. 8. Figured cloth moistened with water makes an excellent embossing surface, and release is easily obtained, since air can penetrate the cloth. The embossed designs maintain their configuration during subsequent fusion.

Stamping

Stamping configurations or designs in plastigel sheets is a rapid method of fabrication, and the speed of the operation does not allow time for the plastigel to soften excessively. Trimmings can be reworked, and one mold serves for unlimited impressions because plastigels can be removed immediately for baking.

Extrusion

The extrusion of plastigels is one of the most promising methods of fabrication. Relatively low pressures are required, which offers the possibility of using low pressure extruders such as are used for extruding ceramic materials. Mold release is no problem with extrusion, and softer formulations may be used by extruding onto a carrier belt, or into a hot liquid bath where the liquid serves not only as a rapid heat transfer medium, but also as a support for the plastigel.

Plastigel tubing may be extruded into a molten "Carbowax" polyethylene glycol bath. Heating is not required for extrusion. Large scale extruders might require water cooling to dissipate functional heat. The retention of the circular cross-section of flexible extruded tubing after fusion is shown by Fig. 9.

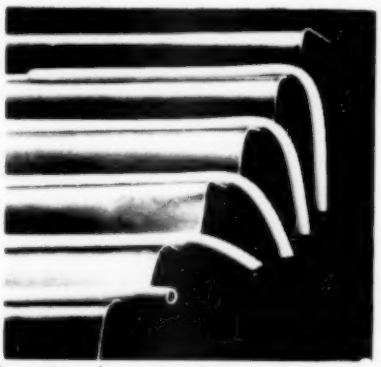


Fig. 9—Illustration shows the degree of shape retention of unsupported ¼ inch O.D. plastigel tubing after fifteen minutes at 350 deg. F. in oven. Tubular shape is retained even in the case where horizontal deflection has occurred.

Conclusions

Plastigels, the baby of the family of methods of application of vinyl resins, although not fully weaned, promises to open new horizons for plastic fabricators. At the present time, molders and extruders have the mechanical ingenuity and tools for fabricating plastigels, while many paint and specialty coating manufacturers already have a backlog of experience with vinyl dispersion resins, which should give them a head start in formulating plastigels for production on their present equipment.

New York Hears Purpose Of Statistical Quality Control

Arthur M. Merrill

The New York Section held another highly successful meeting on May 20 at the Gotham Hotel, with some 110 members and guests attending. President Saul Blitz, Tico Plastics Corp., presided over the meeting which included a cocktail hour, dinner, business session, and technical meeting. Two speakers were featured at the technical session; John D. Hinchen, supervisor of quality control, Monsanto Chemical Co., discussed "Quality Control in the Plastics Industry," and Robert G. Nelb, manager of polyester development, Naugatuck Chemical Co., spoke on "The Future of Reinforced Plastics."

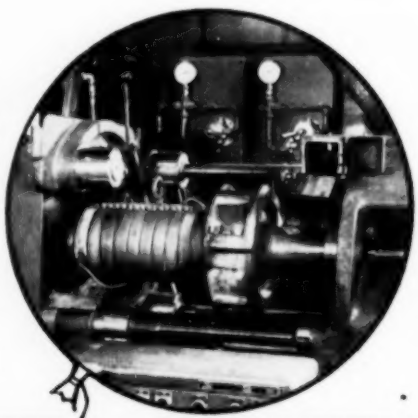
Mr. Hinchen stated that the fundamental basis underlying the use of statistical methods is the principle of variation which holds that it is impossible to make two things exactly alike. Statistical quality control is designed to separate quality variations into two types; those which are normal to the operation and cannot be eliminated without basic redesign of the process, and those which are not inherent in the process and can be eliminated. After fixing the quality limits within which production must be held, the use of statistical quality control charts permits immediate identification of any variation outside these limits.

Dr. Nelb gave an interesting discussion of the manufacture and composition of Vibrin polyester resins, methods of fabrication of reinforced products, and the properties and applications of the finished laminates. He used many samples of parts to illustrate his talk, and also gave a demonstration of the lay-up method of manufacturing glass-reinforced laminates at room temperature.

(Please turn to Page 74)

LICK RISING INJECTION MACHINE COSTS

INSTALL AN



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SOUTH TEXAS PLASTICS DISPLAY

South Texas Section Speaker Talks On Progress in Man-Made Fibers

W. E. Wiese

"Progress In Man-Made Fibers" was the subject discussed by Mr. Leonard H. Schick before the South Texas Section at our regular monthly meeting on May 13th. Mr. Schick is Manager of the Product Information Section of the DuPont Company's Textile Fibers Department. He presented the story of Rayon, Acetate, Nylon, Orlon and Dacron with emphasis on practical consumer information. He demonstrated modern day applications of these fibers to common articles of clothing.

The history of fibers dates back to the earliest times; in fact, the Textile Industry is one of the oldest. The American Indian was wearing handwoven fabrics when Columbus arrived in the year 1492, and even the ancient Mayans and Aztecs had a thriving "Textile Industry." This industry employs today about one-fifth of all working people.

Of the man-made fibers Rayon, introduced in the United States in 1910, is the oldest. The Acetates are almost as old and, like Rayon, are made from cellulose. Both maintain their importance today because of their acceptable properties and low cost.

Nylon, Orlon and Dacron are the three fibers most recently introduced. There is no chemical relationship between them and each has its own physical properties. However, all are easy to care for since they dry quickly, resist mildew and other deteriorating influences and require little or no ironing. They are light in weight and do not shrink.

Nylon is known as the first of the true synthetics, dating from 1938, since its properties can be closely controlled by scientific methods. It is interesting to reflect that the first women's nylon stockings appeared in 1940. Today they are standard for womens' wear. Nylon is outstanding for its strength, abrasion resistance and elasticity.

Orlon is a good general purpose fiber based on acrylonitrile. It is 20-30% lighter than most natural fibers, has some of the same physical properties as Nylon, and it is not readily deteriorated by sunlight.

Dacron polyester fiber is outstanding for its crispness and springiness. It is familiar to the consuming public as men's shirting and suiting material.

To illustrate the apparel uses for man-made fibers, the speaker displayed a selection of garments made from DuPont's five fibers. These included a pleated nightgown, a lightweight but warm nylon-"Orlon" sport jacket, washable sport and dress shirts that need little or no ironing, neckties, socks, skirts, sweaters, and children's items.

After explaining the wear history of each garment, he pointed out that, fibers such as Nylon, 'Orlon' and 'Dacron' are designed not to replace either the natural or the older man-made fibers such as Rayon and Acetate, but to fill a need for textile fibers that meet requirements for specific uses. Because of the diverse requirements of the industry, it is unlikely that there ever will be an all-purpose fiber. Each of the man-made fibers has its own distinctive values which can be adapted for many uses.

Prior to his talk before the SPE group Mr. Schick appeared on the "Fashions in Motion" television program, under the auspices of the local SPE.

As usual, our meeting was held at the Frontier Inn of Houston and the program was preceeded by a social hour and dinner. President Jim Pinkston officiated.

Miami Valley Hears Pribble on Design

John L. Russell

Miami Valley Section SPE members and guests to the number of 65 enjoyed a fine dinner meeting on Thursday May 7 at the Wishing Well, Centerville, O. Mr. Wayne I. Pribble, President of the Barrier, Pribble & Co., Inc., New Haven, Ind. spoke on "Mold Design and Construction." Mr. Pribble, who heads a firm of Plastic Consultants in the field of Mold Design and Mold Construction, related from years of experience in the Design field and presented a very interesting talk.

The large turnout was both a fine tribute to Mr. Pribble and to the excellent programs arranged by President Joe Merke and his Program Chairmen, Otto Fiedler and Bob Gerdes.

Byron Nelson, Head of the Plastics Laboratory of the National Cash Register Co. has been named to represent the NCR on the "Reinforced Plastics Standards Committee" of SPI on Housings and Appliances. This is in recognition of Mr. Nelson's contribution to the field of Reinforced Plastics, through his development of Fiberglas-Polyester parts for NCR Business Machines. Nelson, as you probably already know, co-authored a paper titled "Finishes For and Surface Qualities of Glass Fiber Reinforced Moldings." This paper was presented when he spoke before the Society of the Plastics Industry (SPI), Reinforced Plastics Division, at its 8th Annual Exhibit, Technical and Management Conference, held at the Shoreham Hotel, Washington, D. C. in February.

President Joe Merke and his committee of Officers and Directors are busy with plans for the Annual Summer Picnic, which again will be held at the Terrace Park Country Club, at Milford, O. on Friday, June 26. As in former years, there will be golf, softball, horseshoes, badminton and fishing. An excellent buffet dinner will be served in the club dining room.

Large Mold Construction

(Continued from Page 7)

his freedom is unimpaired and where he has lots of room to perform his work.

Certain precautions to take, and special shop techniques to follow can readily be seen as incident to the construction of large molds.

Since water lines are very long, great care must be taken to see that drills do not drift and come within dangerous proximity of ejector pins, core pins, guide pins, return pins, cams, slides, inserts, or any area where a "break-through" would be next to disastrous. Guide and return pins are usually near the outside edges of the mold and therefore constitute a lesser hazard, but any component located near the center should be given maximum clearance consistent with the requirements of the mold and good general design.

Large molds must be very well supported because of the tremendous molding pressures built up in the cavity, sometimes amounting to several million pounds. Parting line surfaces are often relieved to cut down on land areas, helping to reduce flash.

Keys are sometimes installed to keep cavities from spreading, especially if they are deep and to help maintain proper alignment.

The possibility of using inserts should always be looked for in large mold construction as this often eliminates the necessity for delicate machining in some hard-to-get-at area. Also, when blade ejectors are required, their installation can often be facilitated by putting in round split inserts which can easily be slotted to receive them.

Eyebolts, however insignificant they might seem, are a necessary part of all molds. A proper size and number should always be called for. On large molds the eyebolts $1\frac{1}{4}$" in size, on the mounting side are usually sufficient. All sides are usually tapped to facilitate handling in the shop.

Guide pins are often installed for proper guidance in the ejector plate. Because of the weight of steel involved, ejector pins would often score and sometimes even shear if a means of guiding were not provided. Some customers want ordinary round guide pins, and some want wear plates along parallels for the ejector plate to ride on. Ejector retainer plates are often made up of narrow strips, extending only over ejector pin areas, since in large areas there are no ejector pins at all.

One advantage of large molds is that after all machining has been completed on kellers and mills, five or six men can often work simultaneously on the main cavity and core while performing the subsequent operations of riffling, stoning, benching, and polishing.

One of the indispensable steps in constructing large molds is that of spotting the cavity and core together in a spotting press. This is one of the most important pieces of equipment in our shop, and one which we could not do without. It is virtually impossible to properly mate and align shut-offs and matching edges, and to check for and obtain proper wall thicknesses throughout the mold without a press of this type. With it all of these operations are reduced to simple procedures. After this press has indicated proper register and satisfactory conditions throughout the mold, the final finishing operations can then be confidently and rapidly accomplished.

With the completion of stoning and polishing, another mold will be on its way to play an important part in providing beautiful, durable, mass-produced, low-cost articles to which the consumer public has become accustomed, and for which it has learned to look to the plastics industry.

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New York News

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In the discussion following the talk, Dr. Nelb was joined by representatives of low pressure laminators in the area who displayed samples of their current production and assisted the speaker in answering questions from the floor.

Table favors were distributed through the courtesy of Renwal Mfg. Co. and Naugatuck Chemical, and the meeting concluded with a drawing for door prizes contributed by Ferro Corp., Naugatuck Chemical, and Tico Plastics.

New members added by the Section during the month included Samuel J. Boker, Novo-Plas Mfg. Co., Inc., Nicholas Gerten, Jr., Rainville Co., and a transfer from the Cleveland Section, Robert M. Lane, Caldwell Products Co., Inc. A new junior member, Kenneth Robert Jacobs, was born on April 17 to Mr. and Mrs. Arthur S. Jacobs (Ideal Plastics Corp. and a director of the Section).

Detroit News

Emil R. Gazdick

On May 22nd, the Detroit Section held a dinner meeting at Adrian Cotter's restaurant.

Our speaker for the evening was Mr. C. E. Beyer of the Basic Research Division of Dow Chemical Company. His subject was "Weigh Feeding."

Mr. J. Eveland of the Technical Service Division of Dow Chemical supplemented Mr. Beyer's talk with a discussion of the solution of actual molding problems by the use of "Weigh Feeding."